10. A bank customer borrows X at an annual effective rate of 12.5% and makes level payments at the end of each year for n years.

(i) The interest portion of the final payment is 153.86 .

(ii) The total principal repaid as of time $(n-1)$ is 6009.12 .

(iii) The principal repaid in the first payment is Y .

Calculate Y .

(A) 470

(B) 480

(C) 490

(D) 500

(E) 510

24. A small business takes out a loan of 12,000 at a nominal rate of 12%, compounded quarterly, to help finance its start-up costs. Payments of 750 are made at the end of every 6 months for as long as is necessary to pay back the loan.

Three months before the 9^{th} payment is due, the company refinances the loan at a nominal rate of 9%, compounded monthly. Under the refinanced loan, payments of R are to be made monthly, with the first monthly payment to be made at the same time that the 9^{th} payment under the old loan was to be made. A total of 30 monthly payments will completely pay off the loan.

Determine R .

(A) 448

(B) 452

(C) 456

(D) 461

(E) 465

26. Betty borrows 19,800 from Bank X . Betty repays the loan by making 36 equal payments of principal at the end of each month. She also pays interest on the unpaid balance each month at a nominal rate of 12%, compounded monthly.

Immediately after the 16^{th} payment is made, Bank X sells the rights to future payments to Bank Y . Bank Y wishes to yield a nominal rate of 14%, compounded semi-annually, on its investment.

What price does Bank X receive?

(A) 9,792

(B) 10,823

(C) 10,857

(D) 11,671

(E) 11,709

29. A firm has proposed the following restructuring for one of its 1000 par value bonds.

The bond presently has 10 years remaining until maturity. The coupon rate on the existing bond is 6.75% per annum paid semiannually. The current nominal semiannual yield on the bond is 7.40% .

The company proposes suspending coupon payments for four years with the suspended coupon payments being repaid, with accrued interest, when the bond comes due. Accrued interest is calculated using a nominal semiannual rate of 7.40% .

Calculate the market value of the restructured bond.

(A) 755

(B) 805

(C) 855

(D) 905

(E) 955

43. A 1000 par value 5-year bond with 8.0% semiannual coupons was bought to yield 7.5% convertible semiannually.

Determine the amount of premium amortized in the 6^{th} coupon payment.

(A) 2.00

(B) 2.08

(C) 2.15

(D) 2.25

(E) 2.34

12. Kevin takes out a 10-year loan of L, which he repays by the amortization method at an annual effective interest rate of i. Kevin makes payments of 1000 at the end of each year.

The total amount of interest repaid during the life of the loan is also equal to L.

Calculate the amount of interest repaid during the first year of the loan.

(A) 725

(B) 750

(C) 755

(D) 760

(E) 765

30. A 1000 par value 20-year bond with annual coupons and redeemable at maturity at 1050 is purchased for P to yield an annual effective rate of 8.25% .

The first coupon is 75 . Each subsequent coupon is 3% greater than the preceding coupon.

Determine P .

(A) 985

(B) 1000

(C) 1050

(D) 1075

(E) 1115

34. An investor took out a loan of 150,000 at 8% compounded quarterly, to be repaid over 10 years with quarterly payments of 5483.36 at the end of each quarter. After 12 payments, the interest rate dropped to 6% compounded quarterly. The new quarterly payment dropped to 5134.62 .

After 20 payments in total, the interest rate on the loan increased to 7% compounded quarterly. The investor decided to make an additional payment of X at the time of his 20th payment. After the additional payment was made, the new quarterly payment was calculated to be 4265.73, payable for five more years.

Determine X.

(A) 11,047

(B) 13,369

(C) 16,691

(D) 20,152

(E) 23,614

40. Among a company's assets and accounting records, an actuary finds a 15-year bond that was purchased at a premium. From the records, the actuary has determined the following:

(i) The bond pays semi-annual interest.

(ii) The amount for amortization of the premium in the 2^{nd} coupon payment was 977.19 .

(iii) The amount for amortization of the premium in the 4^{th} coupon payment was 1046.79 .

What is the value of the premium?

(A) 17,365

(B) 24,784

(C) 26,549

(D) 48,739

(E) 50,445

48. A 12-year loan of 8000 is to be repaid with payments to the lender of 800 at the end of each year and deposits of X at the end of each year into a sinking fund.

Interest on the loan is charged at an 8% annual effective rate. The sinking fund annual effective interest rate is 4% .

Calculate X .

(A) 298

(B) 330

(C) 361

(D) 385

(E) 411

55. Iggy borrows X for 10 years at an annual effective rate of 6% . If he pays the principal and accumulated interest in one lump sum at the end of 10 years, he would pay 356.54 more in interest than if he repaid the loan with 10 level payments at the end of each year.

Calculate X .

(A) 800

(B) 825

(C) 850

(D) 875

(E) 900

4. A 20-year loan of 20,000 may be repaid under the following two methods:

i) amortization method with equal annual payments at an annual effective rate of 6.5%

ii) sinking fund method in which the lender receives an annual effective rate of 8% and the sinking fund earns an annual effective rate of j

Both methods require a payment of X to be made at the end of each year for 20 years.

Calculate j.

(A) $j \leq 6.5\%$

(B) $6.5\% < j \leq 8.0\%$

(C) $8.0\% < j \leq 10.0\%$

(D) $10.0\% < j \leq 12.0\%$

(E) $j > 12.0\%$

7. Seth, Janice, and Lori each borrow 5000 for five years at a nominal interest rate of 12%, compounded semi-annually. Seth has interest accumulated over the five years and pays all the interest and principal in a lump sum at the end of five years. Janice pays interest at the end of every six-month period as it accrues and the principal at the end of five years. Lori repays her loan with 10 level payments at the end of every six-month period.

Calculate the total amount of interest paid on all three loans.

(A) 8718

(B) 8728

(C) 8738

(D) 8748

(E) 8758

41. Bill buys a 10-year 1000 par value 6% bond with semi-annual coupons. The price assumes a nominal yield of 6%, compounded semi-annually.

As Bill receives each coupon payment, he immediately puts the money into an account earning interest at an annual effective rate of i.

At the end of 10 years, immediately after Bill receives the final coupon payment and the redemption value of the bond, Bill has earned an annual effective yield of 7% on his investment in the bond.

Calculate i.

(A) 9.50%

(B) 9.75%

(C) 10.00%

(D) 10.25%

(E) 10.50%

6. A 10-year loan of 2000 is to be repaid with payments at the end of each year.

It can be repaid under the following two options:

(i) Equal annual payments at an annual effective rate of 8.07% .

(ii) Installments of 200 each year plus interest on the unpaid balance at an annual effective rate of i .

The sum of the payments under option (i) equals the sum of the payments under option (ii) .

Determine i .

(A) 8.75%

(B) 9.00%

(C) 9.25%

(D) 9.50%

(E) 9.75%

9. A loan is amortized over five years with monthly payments at a nominal interest rate of 9% compounded monthly. The first payment is 1000 and is to be paid one month from the date of the loan. Each succeeding monthly payment will be 2% lower than the prior payment.

Calculate the outstanding loan balance immediately after the 40^{th} payment is made.

(A) 6751

(B) 6889

(C) 6941

(D) 7030

(E) 7344

31. You have decided to invest in two bonds. Bond X is an n-year bond with semi-annual coupons, while bond Y is an accumulation bond redeemable in $\frac{n}{2}$ years. The desired yield rate is the same for both bonds. You also have the following information:

Bond X

- Par value is 1000 .
- The ratio of the semi-annual bond rate to the desired semi-annual yield rate, $\frac{r}{i}$, is 1.03125 .
- The present value of the redemption value is 381.50 .

Bond Y

- Redemption value is the same as the redemption value of bond X .
- Price to yield is 647.80 .

What is the price of bond X?

(A) 1019

(B) 1029

(C) 1050

(D) 1055

(E) 1072

15. John borrows 1000 for 10 years at an annual effective interest rate of 10%. He can repay this loan using the amortization method with payments of P at the end of each year. Instead, John repays the 1000 using a sinking fund that pays an annual effective rate of 14%. The deposits to the sinking fund are equal to P minus the interest on the loan and are made at the end of each year for 10 years.

Determine the balance in the sinking fund immediately after repayment of the loan.

(A) 213

(B) 218

(C) 223

(D) 230

(E) 237

39. A 30-year loan of 1000 is repaid with payments at the end of each year.

Each of the first ten payments equals the amount of interest due. Each of the next 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

42. A 10,000 par value 10-year bond with 8% annual coupons is bought at a premium to yield an annual effective rate of 6%.

Calculate the interest portion of the 7^{th} coupon.

(A) 632

(B) 642

(C) 651

(D) 660

(E) 667

2. Lori borrows 10,000 for 10 years at an annual effective interest rate of 9%. At the end of each year, she pays the interest on the loan and deposits the level amount necessary to repay the principal to a sinking fund earning an annual effective interest rate of 8%.

The total payments made by Lori over the 10-year period is X.

Calculate X.

(A) 15,803

(B) 15,853

(C) 15,903

(D) 15,953

(E) 16,003

5. Susan can buy a zero coupon bond that will pay 1000 at the end of 12 years and is currently selling for 624.60 . Instead she purchases a 6% bond with coupons payable semi-annually that will pay 1000 at the end of 10 years. If she pays X she will earn the same annual effective interest rate as the zero coupon bond.

Calculate X.

(A) 1164

(B) 1167

(C) 1170

(D) 1173

(E) 1176

8. A loan is being repaid with 25 annual payments of 300 each. With the 10th payment, the borrower pays an extra 1000, and then repays the balance over 10 years with a revised annual payment. The effective rate of interest is 8%.

Calculate the amount of the revised annual payment.

(A) 157

(B) 183

(C) 234

(D) 257

(E) 383

11. A 1000 par value bond pays annual coupons of 80. The bond is redeemable at par in 30 years, but is callable any time from the end of the 10^{th} year at 1050.

Based on her desired yield rate, an investor calculates the following potential purchase prices, P:

Assuming the bond is called at the end of the 10^{th} year, $P = 957$

Assuming the bond is held until maturity, $P = 897$

The investor buys the bond at the highest price that guarantees she will receive at least her desired yield rate regardless of when the bond is called.

The investor holds the bond for 20 years, after which time the bond is called.

Calculate the annual yield rate the investor earns.

(A) 8.56%

(B) 9.00%

(C) 9.24%

(D) 9.53%

(E) 9.99%

25. A bank customer takes out a loan of 500 with a 16% nominal interest rate convertible quarterly. The customer makes payments of 20 at the end of each quarter.

Calculate the amount of principal in the fourth payment.

(A) 0.0

(B) 0.9

(C) 2.7

(D) 5.2

(E) There is not enough information to calculate the amount of principal.

4. A ten-year 100 par value bond pays 8% coupons semiannually. The bond is priced at 118.20 to yield an annual nominal rate of 6% convertible semiannually.

Calculate the redemption value of the bond.

(A) 97

(B) 100

(C) 103

(D) 106

(E) 109

11. An investor borrows an amount at an annual effective interest rate of 5% and will repay all interest and principal in a lump sum at the end of 10 years. She uses the amount borrowed to purchase a 1000 par value 10-year bond with 8% semiannual coupons bought to yield 6% convertible semiannually. All coupon payments are reinvested at a nominal rate of 4% convertible semiannually.

Calculate the net gain to the investor at the end of 10 years after the loan is repaid.

(A) 96

(B) 101

(C) 106

(D) 111

(E) 116

16. Dan purchases a 1000 par value 10-year bond with 9% semiannual coupons for 925. He is able to reinvest his coupon payments at a nominal rate of 7% convertible semiannually.

Calculate his nominal annual yield rate convertible semiannually over the ten-year period.

(A) 7.6%

(B) 8.1%

(C) 9.2%

(D) 9.4%

(E) 10.2%

18. A loan is repaid with level annual payments based on an annual effective interest rate of 7%.

The 8^{th} payment consists of 789 of interest and 211 of principal.

Calculate the amount of interest paid in the 18^{th} payment.

(A) 415

(B) 444

(C) 556

(D) 585

(E) 612

22. A 1000 par value bond with coupons at 9% payable semiannually was called for 1100 prior to maturity.

The bond was bought for 918 immediately after a coupon payment and was held to call. The nominal yield rate convertible semiannually was 10%.

Calculate the number of years the bond was held.

(A) 10

(B) 25

(C) 39

(D) 49

(E) 54

24. A 30-year bond with a par value of 1000 and 12% coupons payable quarterly is selling at 850.

Calculate the annual nominal yield rate convertible quarterly.

(A) 3.5%

(B) 7.1%

(C) 14.2%

(D) 14.9%

(E) 15.4%

28.

Ron is repaying a loan with payments of 1 at the end of each year for n years. The annual effective interest rate on the loan is i. The amount of interest paid in year t plus the amount of principal repaid in year $t + 1$ equals X.

Determine which of the following is equal to X.

(A) $1+\frac{v^{n-t}}{i}$

(B) $1+\frac{v^{n-t}}{d}$

(C) $1+v^{n-t}i$

(D) $1+v^{n-t}d$

(E) $1+v^{n-t}$

29.

At an annual effective interest rate of i, $i > 0\%$, the present value of a perpetuity paying 10 at the end of each 3-year period, with the first payment at the end of year 3, is 32.

At the same annual effective rate of i, the present value of a perpetuity paying 1 at the end of each 4-month period, with first payment at the end of 4 months, is X.

Calculate X.

(A) 31.6

(B) 32.6

(C) 33.6

(D) 34.6

(E) 35.6

30.

As of 12/31/2013, an insurance company has a known obligation to pay 1,000,000 on 12/31/2017. To fund this liability, the company immediately purchases 4-year 5% annual coupon bonds totaling 822,703 of par value. The company anticipates reinvestment interest rates to remain constant at 5% through 12/31/2017. The maturity value of the bond equals the par value.

Consider two reinvestment interest rate movement scenarios effective 1/1/2014. Scenario A has interest rates drop by 0.5%. Scenario B has interest rates increase by 0.5%.

Determine which of the following best describes the insurance company's profit or (loss) as of 12/31/2017 after the liability is paid.

(A) Scenario A – 6,610, Scenario B – 11,150

(B) Scenario A – (14,760), Scenario B – 14,420

(C) Scenario A – (18,910), Scenario B – 19,190

(D) Scenario A – (1,310), Scenario B – 1,320

(E) Scenario A – 0, Scenario B – 0

31.

An insurance company has an obligation to pay the medical costs for a claimant. Annual claim costs today are 5000, and medical inflation is expected to be 7% per year. The claimant will receive 20 payments.

Claim payments are made at yearly intervals, with the first claim payment to be made one year from today.

Calculate the present value of the obligation using an annual effective interest rate of 5%.

(A) 87,900

(B) 102,500

(C) 114,600

(D) 122,600

(E) Cannot be determined

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%

46.

Seth borrows X for four years at an annual effective interest rate of 8%, to be repaid with equal payments at the end of each year. The outstanding loan balance at the end of the third year is 559.12.

Calculate the principal repaid in the first payment.

(A) 444

(B) 454

(C) 464

(D) 474

(E) 484

53.

Joe must pay liabilities of 1,000 due one year from now and another 2,000 due three years from now. There are two available investments:

Bond I: A one-year zero-coupon bond that matures for 1000. The yield rate is 6% per year

Bond II: A two-year zero-coupon bond with face amount of 1,000. The yield rate is 7% per year.

At the present time the one-year forward rate for an investment made two years from now is 6.5%

Joe plans to buy amounts of each bond. He plans to reinvest the proceeds from Bond II in a one-year zero-coupon bond. Assuming the reinvestment earns the forward rate, calculate the total purchase price of Bond I and Bond II where the amounts are selected to exactly match the liabilities.

(A) 2584
(B) 2697
(C) 2801
(D) 2907
(E) 3000

54.

Matt purchased a 20-year par value bond with an annual nominal coupon rate of 8% payable semiannually at a price of 1722.25. The bond can be called at par value X on any coupon date starting at the end of year 15 after the coupon is paid. The lowest yield rate that Matt can possibly receive is a nominal annual interest rate of 6% convertible semiannually.

Calculate X.

(A) 1400
(B) 1420
(C) 1440
(D) 1460
(E) 1480

55.

Toby purchased a 20-year par value bond with semiannual coupons of 40 and a redemption value of 1100. The bond can be called at 1200 on any coupon date prior to maturity, starting at the end of year 15.

Calculate the maximum price of the bond to guarantee that Toby will earn an annual nominal interest rate of at least 6% convertible semiannually.

(A) 1251

(B) 1262

(C) 1278

(D) 1286

(E) 1295

56.

Sue purchased a 10-year par value bond with an annual nominal coupon rate of 4% payable semiannually at a price of 1021.50. The bond can be called at par value X on any coupon date starting at the end of year 5. The lowest yield rate that Sue can possibly receive is an annual nominal rate of 6% convertible semiannually.

Calculate X.

(A) 1120

(B) 1140

(C) 1160

(D) 1180

(E) 1200

57.

Mary purchased a 10-year par value bond with an annual nominal coupon rate of 4% payable semiannually at a price of 1021.50. The bond can be called at 100 over the par value of 1100 on any coupon date starting at the end of year 5 and ending six months prior to maturity.

Calculate the minimum yield that Mary could receive, expressed as an annual nominal rate of interest convertible semiannually.

(A) 4.7%

(B) 4.9%

(C) 5.1%

(D) 5.3%

(E) 5.5%

58. Moved to Derivatives Section

59.

A liability consists of a series of 15 annual payments of 35,000 with the first payment to be made one year from now.

The assets available to immunize this liability are five-year and ten-year zero-coupon bonds.

The annual effective interest rate used to value the assets and the liability is 6.2%. The liability has the same present value and duration as the asset portfolio.

Calculate the amount invested in the five-year zero-coupon bonds.

(A) 127,000

(B) 167,800

(C) 208,600

(D) 247,900

(E) 292,800

60.

You are given the following information about a loan of L that is to be repaid with a series of 16 annual payments:

(i) The first payment of 2000 is due one year from now.

(ii) The next seven payments are each 3% larger than the preceding payment.

(iii) From the 9th to the 16th payment, each payment will be 3% less than the preceding payment.

(iv) The loan has an annual effective interest rate of 7%.

Calculate L.

(A) 20,689

(B) 20,716

(C) 20,775

(D) 21,147

(E) 22,137

OR

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

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

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

62.

A 40-year bond is purchased at a discount. The bond pays annual coupons. The amount for accumulation of discount in the 15th coupon is 194.82. The amount for accumulation of discount in the 20th coupon is 306.69.

Calculate the amount of discount in the purchase price of this bond.

(A) 13,635
(B) 13,834
(C) 16,098
(D) 19,301
(E) 21,135

63.

Tanner takes out a loan today and repays the loan with eight level annual payments, with the first payment one year from today. The payments are calculated based on an annual effective interest rate of 4.75%. The principal portion of the fifth payment is 699.68.

Calculate the total amount of interest paid on this loan.

(A) 1239
(B) 1647
(C) 1820
(D) 2319
(E) 2924

64.

Turner buys a new car and finances it with a loan of 22,000. He will make n monthly payments of 450.30 starting in one month. He will make one larger payment in $n+1$ months to pay off the loan. Payments are calculated using an annual nominal interest rate of 8.4%, convertible monthly. Immediately after the 18th payment he refinances the loan to pay off the remaining balance with 24 monthly payments starting one month later. This refinanced loan uses an annual nominal interest rate of 4.8%, convertible monthly.

Calculate the amount of the new monthly payment.

(A) 668

(B) 693

(C) 702

(D) 715

(E) 742

65.

Kylie bought a 7-year, 5000 par value bond with an annual coupon rate of 7.6% paid semiannually. She bought the bond with no premium or discount.

Calculate the Macaulay duration of this bond with respect to the yield rate on the bond.

(A) 5.16

(B) 5.35

(C) 5.56

(D) 5.77

(E) 5.99

74.

You are given the following information about two bonds, Bond A and Bond B:

i) Each bond is a 10-year bond with semiannual coupons redeemable at its par value of 10,000, and is bought to yield an annual nominal interest rate of i, convertible semiannually.

ii) Bond A has an annual coupon rate of $(i + 0.04)$, paid semiannually.

iii) Bond B has an annual coupon rate of $(i - 0.04)$, paid semiannually.

iv) The price of Bond A is 5,341.12 greater than the price of Bond B.

Calculate i.

(A) 0.042

(B) 0.043

(C) 0.081

(D) 0.084

(E) 0.086

75.

A borrower takes out a 15-year loan for 400,000, with level end-of-month payments, at an annual nominal interest rate of 9% convertible monthly.

Immediately after the 36th payment, the borrower decides to refinance the loan at an annual nominal interest rate of j, convertible monthly. The remaining term of the loan is kept at twelve years, and level payments continue to be made at the end of the month. However, each payment is now 409.88 lower than each payment from the original loan.

Calculate j.

(A) 4.72%

(B) 5.75%

(C) 6.35 %

(D) 6.90%

(E) 9.14%

76.

Consider two 30-year bonds with the same purchase price. Each has an annual coupon rate of 5% paid semiannually and a par value of 1000.

The first bond has an annual nominal yield rate of 5% compounded semiannually, and a redemption value of 1200.

The second bond has an annual nominal yield rate of j compounded semiannually, and a redemption value of 800.

Calculate j.

(A) 2.20%

(B) 2.34%

(C) 3.53%

(D) 4.40%

(E) 4.69%

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

80.

A student takes out a five-year loan of 1000. Interest on the loan is at an annual effective interest rate of i.

At the end of each year, the student pays the interest due on the loan and makes a deposit of twice the amount of that interest payment into a sinking fund. The sinking fund credits interest at an annual effective rate of $0.8i$. The sinking fund will accumulate the amount needed to pay off the loan at the end of five years.

Calculate i.

(A) 7.2%

(B) 8.4%

(C) 8.7%

(D) 10.6%

(E) 12.1%

81.

A borrower takes out a 50-year loan, to be repaid with payments at the end of each year. The loan payment is 2500 for each of the first 26 years. Thereafter, the payments decrease by 100 per year. Interest on the loan is charged at an annual effective rate of i ($0\% < i < 10\%$).

The principal repaid in year 26 is X.

Determine the amount of interest paid in the first year.

(A) Xv^{25}

(B) $2500v^{25} - Xv^{25}$

(C) $2500 - X$

(D) $2500 - XV^{25}$

(E) $25Xi$

86.

A loan of 10,000 is repaid with a payment made at the end of each year for 20 years. The payments are 100, 200, 300, 400, and 500 in years 1 through 5, respectively. In the subsequent 15 years, equal annual payments of X are made.

The annual effective interest rate is 5%.

Calculate X.

(A) 842

(B) 977

(C) 1017

(D) 1029

(E) 1075

87.

An investor wishes to accumulate 5000 in a fund at the end of 15 years. To accomplish this, she plans to make equal deposits of X at the end of each year for the first ten years. The fund earns an annual effective rate of 6% during the first ten years and 5% for the next five years.

Calculate X.

(A) 224

(B) 284

(C) 297

(D) 312

(E) 379

88.

A borrower takes out a 15-year loan for 65,000, with level end-of-month payments. The annual nominal interest rate of the loan is 8%, convertible monthly.

Immediately after the 12th payment is made, the remaining loan balance is reamortized. The maturity date of the loan remains unchanged, but the annual nominal interest rate of the loan is changed to 6%, convertible monthly.

Calculate the new end-of-month payment.

(A) 528

(B) 534

(C) 540

(D) 546

(E) 552

89.

College tuition is 6000 for the current school year, payable in full at the beginning of the school year. College tuition will grow at an annual rate of 5%. A parent sets up a college savings fund earning interest at an annual effective rate of 7%. The parent deposits 750 at the beginning of each school year for 18 years, with the first deposit made at the beginning of the current school year. Immediately following the 18th deposit, the parent pays tuition for the 18th school year from the fund.

The amount of money needed, in addition to the balance in the fund, to pay tuition at the beginning of the 19th school year is X.

Calculate X.

(A) 1439

(B) 1545

(C) 1664

(D) 1785

(E) 1870

90.

A 1000 par value 20-year bond sells for P and yields a nominal interest rate of 10% convertible semiannually. The bond has 9% coupons payable semiannually and a redemption value of 1200.

Calculate P.

(A) 914

(B) 943

(C) 1013

(D) 1034

(E) 1097

91.

An investor purchases a 10-year callable bond with face amount of 1000 for price P. The bond has an annual nominal coupon rate of 10% paid semi-annually.

The bond may be called at par by the issuer on every other coupon payment date, beginning with the second coupon payment date.

The investor earns at least an annual nominal yield of 12% compounded semi-annually regardless of when the bond is redeemed.

Calculate the largest possible value of P.

(A) 885

(B) 892

(C) 926

(D) 965

(E) 982

100.

An investor owns a bond that is redeemable for 300 in seven years. The investor has just received a coupon of 22.50 and each subsequent semiannual coupon will be X more than the preceding coupon. The present value of this bond immediately after the payment of the coupon is 1050.50 assuming an annual nominal yield rate of 6% convertible semiannually.

Calculate X.

(A) 7.54

(B) 10.04

(C) 22.37

(D) 34.49

(E) 43.98

101.

A 30-year annuity is arranged to pay off a loan taken out today at a 5% annual effective interest rate. The first payment of the annuity is due in ten years in the amount of 1,000. The subsequent payments increase by 500 each year.

Calculate the amount of the loan.

(A) 58,283

(B) 61,197

(C) 64,021

(D) 64,257

(E) 69,211

106.

A company takes out a loan of 15,000,000 at an annual effective discount rate of 5.5%. You are given:

i) The loan is to be repaid with n annual payments of 1,200,000 plus a drop payment one year after the nth payment.

ii) The first payment is due three years after the loan is taken out.

Calculate the amount of the drop payment.

(A) 79,100

(B) 176,000

(C) 321,300

(D) 959,500

(E) 1,180,300

107.

Tim takes out an n-year loan with equal annual payments at the end of each year.

The interest portion of the payment at time $(n - 1)$ is equal to 0.5250 of the interest portion of the payment at time $(n - 3)$ and is also equal to 0.1427 of the interest portion of the first payment.

Calculate n.

(A) 18

(B) 20

(C) 22

(D) 24

(E) 26

108.

You are given the following information about an eleven-year loan of L to be repaid by the sinking fund method:

i) The sinking fund earns an annual effective interest rate of 4.70%.

ii) Immediately following the seventh payment and deposit, the difference between what is owed to the lender on the loan and the accumulated value of the sinking fund is 6241.

Calculate the sinking fund deposit.

(A) 1019

(B) 1055

(C) 1067

(D) 1084

(E) 1104

109.

On January 1, 2003 Mike took out a 30-year mortgage loan in the amount of 200,000 at an annual nominal interest rate of 6% compounded monthly. The loan was to be repaid by level end-of-month payments with the first payment on January 31, 2003.

Mike repaid an extra 10,000 in addition to the regular monthly payment on each December 31 in the years 2003 through 2007.

Determine the date on which Mike will make his last payment (which is a drop payment).

(A) July 31, 2013

(B) November 30, 2020

(C) December 31, 2020

(D) December 31, 2021

(E) January 31, 2022

110.

A 5-year loan of 500,000 with an annual effective discount rate of 8% is to be repaid by level end-of-year payments.

If the first four payments had been rounded up to the next multiple of 1,000, the final payment would be X.

Calculate X.

(A) 103,500

(B) 111,700

(C) 115,200

(D) 125,200

(E) 127,500

111

A company plans to invest X at the beginning of each month in a zero-coupon bond in order to accumulate 100,000 at the end of six months. The price of each bond as a percentage of redemption value is given in the following chart:

Maturity (months)	1	2	3	4	5	6
Price	99%	98%	97%	96%	95%	94%

Calculate X given that the bond prices will not change during the six-month period.

(A) 15,667

(B) 16,078

(C) 16,245

(D) 16,667

(E) 17,271

112.

A loan of X is repaid with level annual payments at the end of each year for 10 years.

You are given:

i) The interest paid in the first year is 3600; and

ii) The principal repaid in the 6^{th} year is 4871.

Calculate X.

(A) 44,000

(B) 45,250

(C) 46,500

(D) 48,000

(E) 50,000

113.

An investor purchased a 25-year bond with semiannual coupons, redeemable at par, for a price of 10,000. The annual effective yield rate is 7.05%, and the annual coupon rate is 7%.

Calculate the redemption value of the bond.

(A) 9,918

(B) 9,942

(C) 9,981

(D) 10,059

(E) 10,083

114.

Jeff has 8000 and would like to purchase a 10,000 bond. In doing so, Jeff takes out a 10 year loan of 2000 from a bank and will make interest-only payments at the end of each month at a nominal rate of 8.0% convertible monthly. He immediately pays 10,000 for a 10-year bond with a par value of 10,000 and 9.0% coupons paid monthly.

Calculate the annual effective yield rate that Jeff will realize on his 8000 over the 10-year period.

(A) 9.30%

(B) 9.65%

(C) 10.00%

(D) 10.35%

(E) 10.70%

115.

A bank issues three annual coupon bonds redeemable at par, all with the same term, price, and annual effective yield rate.

The first bond has face value 1000 and annual coupon rate 5.28%.

The second bond has face value 1100 and annual coupon rate 4.40%.

The third bond has face value 1320 and annual coupon rate r.

Calculate r.

(A) 2.46%

(B) 2.93%

(C) 3.52%

(D) 3.67%

(E) 4.00%

116.

An investor owns a bond that is redeemable for 250 in 6 years from now. The investor has just received a coupon of c and each subsequent semiannual coupon will be 2% larger than the preceding coupon. The present value of this bond immediately after the payment of the coupon is 582.53 assuming an annual effective yield rate of 4%.

Calculate c.

(A) 32.04

(B) 32.68

(C) 40.22

(D) 48.48

(E) 49.45

117.

An n-year bond with annual coupons has the following characteristics:

i) The redemption value at maturity is 1890;

ii) The annual effective yield rate is 6%;

iii) The book value immediately after the third coupon is 1254.87; and

iv) The book value immediately after the fourth coupon is 1277.38.

Calculate n.

(A) 16

(B) 17

(C) 18

(D) 19

(E) 20

118.

An n-year bond with semiannual coupons has the following characteristics:

i) The par value and redemption value are 2500;

ii) The annual coupon rate is 7% payable semi-annually;

iii) The annual nominal yield to maturity is 8% convertible semiannually; and

iv) The book value immediately after the fourth coupon is 8.44 greater than the book value immediately after the third coupon.

Calculate n.

(A) 6.5

B) 7.0

(C) 9.5

(D) 12.0

(E) 14.0

119.

For the next four years, the one-year forward rates of interest are estimated to be:

Year	0	1	2	3	4
Forward Rate	4%	6%	8%	10%	12%

Calculate the spot rate for a zero-coupon bond maturing three years from now.

(A) 4%

(B) 5%

(C) 6%

(D) 7%

(E) 8%

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