Section 1.15

Sample Exam Problems

1. (2005 Exam FM Sample Questions #1)

Bruce deposits 100 into a bank account. His account is credited interest at a 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 a 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

2. (2005 Exam FM Sample Questions #3)

Eric deposits 100 into a savings account at time 0, which pays interest at a nominal rate of i, compounded semiannually.

Mike deposits 200 into a different savings account at time 0, which pays simple interest at an annual rate of i.

Eric and Mike earn the same amount of interest during the last 6 months of the 8th year. Calculate i.

(A) 9.06% (B) 9.26% (C) 9.46% (D) 9.66% (E) 9.86%

3. (2005 Exam FM Sample Questions #12)

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

4. (2005 Exam FM Sample Questions #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

5. (2005 Exam FM Sample Questions #20)

David can receive one of the following two payment streams:

(i) 100 at time 0, 200 at time n, and 300 at time $2n$
(ii) 600 at time 10

At an annual effective interest rate of i, the present values of the two streams are equal. Given $v^n = 0.76$, determine i.

(A) 3.5% (B) 4.0% (C) 4.5% (D) 5.0% (E) 5.5%

6. (2005 Exam FM Sample Questions #27)

Bruce and Robbie each open up new bank accounts at time 0. Bruce deposits 100 into his bank account, and Robbie deposits 50 into his. Each account earns the same annual effective interest rate.

The amount of interest earned in Bruce's account during the 11th year is equal to X. The amount of interest earned in Robbie's account during the 17th year is also equal to X. Calculate X.

(A) 28.0 (B) 31.3 (C) 34.6 (D) 36.7 (E) 38.9

7. (May 05, #13)

At a nominal interest rate of i convertible semi-annually, an investment of 1000 immediately and 1500 at the end of the first year will accumulate to 2600 at the end of the second year. Calculate i.

(A) 2.75% (B) 2.77% (C) 2.79% (D) 2.81% (E) 2.83%

8. **(May 05, #18)**

A store is running a promotion during which customers have two options for payment.

Option one is to pay 90% of the purchase price two months after the date of sale.

Option two is to deduct X% off the purchase price and pay cash on the date of sale.

A customer wishes to determine X such that he is indifferent between the two options when valuing them using an effective annual interest rate of 8%.

Which of the following equations of value would the customer need to solve?

A) $\left(\frac{X}{100}\right)\left(1+\frac{0.08}{6}\right)=.90$ B) $\left(1-\frac{X}{100}\right)\left(1+\frac{0.08}{6}\right)=.90$

C) $\left(\frac{X}{100}\right)(1.08)^{1/6}=.90$ D) $\left(\frac{X}{100}\right)\left(\frac{1.08}{1.06}\right)=.90$

E) $\left(1-\frac{X}{100}\right)(1.08)^{1/6}=.90$

9. **(May 05, #19)**

Calculate the nominal rate of discount convertible monthly that is equivalent to a nominal rate of interest of 18.9% per year convertible monthly.

(A) 18.0% (B) 18.3% (C) 18.6% (D) 18.9% (E) 19.2%

10. **(Nov 05, #7)**

A bank offers the following choices for certificates of deposit:

Term (in years)	Nominal annual interest rate convertible quarterly
1	4.00%
3	5.00%
5	5.65%

The certificates mature at the end of the term. The bank does NOT permit early withdrawals. During the next 6 years the bank will continue to offer certificates of deposit with the same terms and interest rates.

An investor initially deposits 10,000 in the bank and withdraws both principal and interest at the end of 6 years. Calculate the maximum annual effective rate of interest the investor can earn over the 6-year period.

(A) 5.09% (B) 5.22% (C) 5.35% (D) 5.48% (E) 5.61%

11. **(Nov 05, #25)**

The parents of three children, ages 1, 3, and 6, wish to set up a trust fund that will pay X to each child upon attainment of age 18, and Y to each child upon attainment of age 21.

They will establish the trust fund with a single investment of Z.

Which of the following is the correct equation of value for Z ?

(A) $\dfrac{X}{v^{17}+v^{15}+v^{12}}+\dfrac{Y}{v^{20}+v^{18}+v^{15}}$

(B) $3\left[Xv^{18}+Yv^{21}\right]$

(C) $3Xv^{3}+Y\left[v^{20}+v^{18}+v^{15}\right]$

(D) $(X+Y)\dfrac{v^{20}+v^{18}+v^{15}}{v^{3}}$

(E) $X\left[v^{17}+v^{15}+v^{12}\right]+Y\left[v^{20}+v^{18}+v^{15}\right]$

Section 2.23

Sample Exam Problems

1. **(2005 Exam FM Sample Questions #2)**
Kathryn deposits 100 into an account at the beginning of each 4-year period for 40 years. The account credits interest at an annual effective interest rate of i.

The accumulated amount in the account at the end of 40 years is X, which is 5 times the accumulated amount in the account at the end of 20 years. Calculate X.

(A) 4695 (B) 5070 (C) 5445 (D) 5820 (E) 6195

2. **(2005 Exam FM Sample Questions #6)**

A perpetuity costs 77.1 and makes annual payments at the end of the year. The perpetuity pays 1 at the end of year 2, 2 at the end of year 3, ..., n at the end of year $(n+1)$. After year $(n+1)$, the payments remain constant at n. The annual effective interest rate is 10.5%. Calculate n.

(A) 17 (B) 18 (C) 19 (D) 20 (E) 21

3. **(2005 Exam FM Sample Questions #7)**

1000 is deposited into Fund X, which earns an annual effective rate of 6%. At the end of each year, the interest earned plus an additional 100 is withdrawn from the fund. At the end of the tenth year, the fund is depleted. The annual withdrawals of interest and principal are deposited into Fund Y, which earns an annual effective rate of 9%.

Determine the accumulated value of Fund Y at the end of year 10.
(A) 1519 (B) 1819 (C) 2085 (D) 2273 (E) 2431

4. **(2005 Exam FM Sample Questions #11)**

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. The annual effective rate of interest is 8%.

Calculate X.

(A) 54 (B) 64 (C) 74 (D) 84 (E) 94

5. **(2005 Exam FM Sample Questions #14)**

Mike buys a perpetuity-immediate with varying annual payments. During the first 5 years, the payment is constant and equal to 10. Beginning in year 6, the payments start to increase. For year 6 and all future years, the current year's payment is $K\%$ larger than the previous year's payment. At an annual effective interest rate of 9.2%, the perpetuity has a present value of 167.50.

Calculate K, given $K < 9.2$.

(A) 4.0 (B) 4.2 (C) 4.4 (D) 4.6 (E) 4.8

6. **(2005 Exam FM Sample Questions #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 $(1+i)^n = 2$ Determine i.

(A) 11.25% (B) 11.75% (C) 12.25% (D) 12.75% (E) 13.25%

7. **(2005 Exam FM Sample Questions #18)**

Olga buys a 5-year increasing annuity for X. Olga will receive 2 at the end of the first month, 4 at the end of the second month, and for each month thereafter the payment increases by 2. The nominal interest rate is 9% convertible quarterly.

Calculate X.

(A) 2680 (B) 2730 (C) 2780 D) 2830 (E) 2880

8. **(2005 Exam FM Sample Questions #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 10 years, the account is worth 20,000.

Calculate k.

(A) 111 (B) 116 (C) 121 (D) 126 (E) 131

9. **(2005 Exam FM Sample Questions #25)**

A perpetuity-immediate pays X per year. Brian receives the first n payments, Colleen receives the next n payments, and Jeff receives the remaining payments. Brian's share of the present value of the original perpetuity is 40%, and Jeff's share is K.

Calculate K.

(A) 24% (B) 28% (C) 32% (D) 36% (E) 40%

10. **(2005 Exam FM Sample Questions #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

11. **(2005 Exam FM Sample Questions #31)**

An insurance company has an obligation to pay the medical costs for a claimant. Average annual claims costs today are \$5,000, and medical inflation is expected to be 7% per year. The claimant is expected to live an additional 20 years. Claim payments are made at yearly intervals, with the first claim payment to be made one year from today.

Find the present value of the obligation if the annual interest rate is 5%.

(A) 87,932 (B) 102,514 (C) 114,611
(D) 122,634 (E) Cannot be determined

12. **(2005 Exam FM Sample Questions #48)**
A man turns 40 today and wishes to provide supplemental retirement income of 3000 at the beginning of each month starting on his 65th birthday. Starting today, he makes monthly contributions of X to a fund for 25 years. The fund earns a nominal rate of 8% compounded monthly. On his 65th birthday, each 1000 of the fund will provide 9.65 of income at the beginning of each month starting immediately and continuing as long as he survives.

Calculate X.

(A) 324.73 (B) 326.89 (C) 328.12 (D) 355.45 (E) 450.65

13. (2005 Exam FM Sample Questions #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 18th, 19th, 20th and 21st birthdays to fund her college education. They plan to contribute X at each of their daughter's 1st through 17th birthdays to fund the four 50,000 withdrawals. If they anticipate earning a constant 5% annual effective rate on their contributions, which the following equations of value can be used to determine X, assuming compound interest?

(A) $X\left[v_{.05}^{1}+v_{.05}^{2}+\ldots+v_{.05}^{17}\right]=50{,}000\left[v_{.05}^{1}+\ldots+v_{.05}^{4}\right]$

(B) $X\left[(1.05)^{16}+(1.05)^{15}+\ldots+1.05^{1}\right]=50{,}000\left[1+\ldots+v_{.05}^{3}\right]$

(C) $X\left[(1.05)^{17}+(1.05)^{16}+\ldots+1\right]=50{,}000\left[1+\ldots+v_{.05}^{3}\right]$

(D) $X\left[(1.05)^{17}+(1.05)^{16}+\ldots+(1.05)^{1}\right]=50{,}000\left[1+\ldots+v_{.05}^{3}\right]$

(E) $X\left[v_{.05}^{1}+v_{.05}^{2}+\ldots+v_{.05}^{17}\right]=50{,}000\left[v_{.05}^{18}+\ldots+v_{.05}^{22}\right]$

14. (May 05 #1)

Which of the following expressions does NOT represent a definition for $a_{\overline{n}|}$?

(A) $v^{n}\left[\dfrac{(1+i)^{n}-1}{i}\right]$ (B) $\dfrac{1-v^{n}}{i}$ (C) $v+v^{2}+\ldots+v^{n}$

(D) $v\left[\dfrac{1-v^{n}}{1-v}\right]$ (E) $\dfrac{s_{\overline{n}|}}{(1+i)^{n-1}}$

15. (May 05 #4)

An estate provides a perpetuity with payments of X at the end of each year. Seth, Susan, and Lori share the perpetuity such that Seth receives the payments of X for the first n years and Susan receives the payments of X for the next m years, after which Lori receives all the remaining payments of X. Which of the following represents the difference between the present value of Seth's and Susan's payments using a constant rate of interest?

(A) $X\left[a_{\overline{n}|}-v^{n}a_{\overline{m}|}\right]$ (B) $X\left[\ddot{a}_{\overline{n}|}-v^{n}\ddot{a}_{\overline{m}|}\right]$ (C) $X\left[a_{\overline{n}|}-v^{n+1}a_{\overline{m}|}\right]$

(D) $X\left[a_{\overline{n}|}-v^{n-1}a_{\overline{m}|}\right]$ (E) $X\left[va_{\overline{n}|}-v^{n+1}a_{\overline{m}|}\right]$

16. **(May 05 #9)**

The present value of a series of 50 payments starting at 100 at the end of the first year and increasing by 1 each year thereafter is equal to X. The annual effective rate of interest is 9%. Calculate X.

(A) 1165 (B) 1180 (C) 1195 (D) 1210 (E) 1225

17. **(May 05 #12)**

Which of the following are characteristics of all perpetuities?

I. The present value is equal to the first payment divided by the annual effective interest rate.
II. Payments continue forever.
III. Each payment is equal to the interest earned on the principal.

(A) I only
(B) II only
(C) III only
(D) I, II, and III
(E) The correct answer is not given by (A), (B), (C), or (D).

18. **(May 05 #14)**

An annuity-immediate pays 20 per year for 10 years, then decreases by 1 per year for 19 years. At an annual effective interest rate of 6%, the present value is equal to X. Calculate X.

(A) 200 (B) 205 (C) 210 (D) 215 (E) 220

19. **(May 05 #17)**

At an annual effective interest rate of i, the present value of a perpetuity-immediate starting with a payment of 200 in the first year and increasing by 50 each year thereafter is 46,530. Calculate i.

(A) 3.25% (B) 3.50% (C) 3.75% (D) 4.00% (E) 4.25%

20. **(May 05 #20)**

An investor wishes to accumulate 10,000 at the end of 10 years by making level deposits at the beginning of each year. The deposits earn a 12% annual effective rate of interest paid at the end of each year. The interest is immediately reinvested at an annual effective interest rate of 8%.

Calculate the level deposit.

(A) 541 (B) 572 (C) 598 (D) 615 (E) 621

21. (May 05 #21)

A discount electronics store advertises the following financing arrangement: "We don't offer you confusing interest rates. We'll just divide your total cost by 10 and you can pay us that amount each month for a year." The first payment is due on the date of sale and the remaining eleven payments at monthly intervals thereafter.

Calculate the effective annual interest rate the store's customers are paying on their loans.

(A) 35.1% (B) 41.3% (C) 42.0% (D) 51.2% (E) 54.9%

22. (May 05 #24)

An annuity pays 1 at the end of each year for n years. Using an annual effective interest rate of i, the accumulated value of the annuity at time $(n+1)$ is 13.776. It is also known that $(1+i)^n = 2.476$.

Calculate n.

(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

23. (Nov 05 #3)

An investor accumulates a fund by making payments at the beginning of each month for 6 years. Her monthly payment is 50 for the first 2 years, 100 for the next 2 years, and 150 for the last 2 years. At the end of the 7th year the fund is worth 10,000. The annual effective interest rate is i, and the monthly effective interest rate is j.

Which of the following formulas represents the equation of value for this fund accumulation?

(A) $\ddot{s}_{\overline{24}|i}(1+i)\left[(1+i)^4+2(1+i)^2+3\right]=200$

(B) $\ddot{s}_{\overline{24}|i}(1+j)\left[(1+j)^4+2(1+j)^2+3\right]=200$

(C) $\ddot{s}_{\overline{24}|j}(1+i)\left[(1+i)^4+2(1+i)^2+3\right]=200$

(D) $s_{\overline{24}|j}(1+i)\left[(1+i)^4+2(1+i)^2+3\right]=200$

(E) $s_{\overline{24}|i}(1+i)\left[(1+j)^4+2(1+j)^2+3\right]=200$

24. (Nov 05 #8)

Matthew makes a series of payments at the beginning of each year for 20 years. The first payment is 100. Each subsequent payment through the tenth year increases by 5% from the previous payment. After the tenth payment, each payment decreases by 5% from the previous payment.

Calculate the present value of these payments at the time the first payment is made using an annual effective rate of 7%.

(A) 1375 (B) 1385 (C) 1395 (D) 1405 (E) 1415

25. (Nov 05 #9)

A company deposits 1000 at the beginning of the first year and 150 at the beginning of each subsequent year into perpetuity. In return the company receives payments at the end of each year forever. The first payment is 100. Each subsequent payment increases by 5%.

Calculate the company's yield rate for this transaction.

(A) 4.7% (B) 5.7% (C) 6.7% (D) 7.7% (E) 8.7%

26. (Nov 05 #12)

Megan purchases a perpetuity-immediate for 3250 with annual payments of 130. At the same price and interest rate, Chris purchases an annuity-immediate with 20 annual payments that begin at amount P and increase by 15 each year thereafter. Calculate P.

(A) 90 (B) 116 (C) 131 (D) 176 (E) 239

27. (Nov 05 #13)

For 10,000, Kelly purchases an annuity-immediate that pays 400 quarterly for the next 10 years. Calculate the annual nominal interest rate convertible monthly earned by Kelly's investment.

(A) 10.0% (B) 10.3% (C) 10.5% (D) 10.7% (E) 11.0%

28. (Nov 05 #14)

Payments of X are made at the beginning of each year for 20 years. These payments earn interest at the end of each year at an annual effective rate of 8%. The interest is immediately reinvested at an annual effective rate of 6%. At the end of 20 years, the accumulated value of the 20 payments and the reinvested interest is 5600. Calculate X.

(A) 121.67 (B) 123.56 (C) 125.72 (D) 127.18 (E) 128.50

29. (Nov 05 #23)

The present value of a 25-year annuity-immediate with a first payment of 2500 and decreasing by 100 each year thereafter is X. Assuming an annual effective interest rate of 10%, calculate X.

(A) 11,346 (B) 13,615 (C) 15,923 (D) 17,396 (E) 18,112

Section 3.12

Sample Exam Problems

1. **(2005 Exam FM Sample Questions #4)**
John borrows 10,000 for 10 years at an annual effective interest rate of 10%. He can repay this loan using the amortization method with payments of 1,627.45 at the end of each year. Instead, John repays the 10,000 using a sinking fund that pays an annual effective interest rate of 14%. The deposits to the sinking fund are equal to 1,627.45 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) 2,130 (B) 2,180 (C) 2,230 (D) 2,300 (E) 2,370

2. **(2005 Exam FM Sample Questions #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

3. **(2005 Exam FM Sample Questions #15)**
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%

4. **(2005 Exam FM Sample Questions #16)**
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 40th payment is made.

   (A) 6751 (B) 6889 (C) 6941 (D) 7030 (E) 7344

5. **(2005 Exam FM Sample Questions #24)**
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) $j \le 6.5\%$ (B) $6.5\% < j \le 8.0\%$ (C) $8.0\% < j \le 10.0\%$
(D) $10.0\% < j \le 12.0\%$ (E) $j > 12.0\%$

6. **(2005 Exam FM Sample Questions #26)**
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

7. **(2005 Exam FM Sample Questions #28)**
Ron is repaying a loan with payments of 1 at the end of each year for n years. The amount of interest paid in period t plus the amount of principal repaid in period $t + 1$ equals X.

Calculate X.

(A) $1+\frac{v^{n-1}}{i}$ (B) $1+\frac{v^{n-1}}{d}$ (C) $1+v^{n-t}i$ (D) $1+v^{n-t}d$ (E) $1+v^{n-t}$

8. **(2005 Exam FM Sample Questions #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

9. (May 05 #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

10. (May 05 #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

11. (May 05 #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.

12. (Nov 05 #18)
A loan is repaid with level annual payments based on an annual effective interest rate of 7%. The 8th payment consists of 789 of interest and 211 of principal.

Calculate the amount of interest paid in the 18th payment.

(A) 415 (B) 444 (C) 556 (D) 585 (E) 612

Section 4.8

Sample Exam Problems

1. **(2005 Exam FM Sample Questions #10)**
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 7th coupon.
(A) 632 (B) 642 (C) 651 (D) 660 (E) 667

2. **(2005 Exam FM Sample Questions #2)**
You have decided to invest in Bond X, an n-year bond with semi-annual coupons and the following characteristics:
- Par value is 1000.
- The ratio of the semi-annual coupon rate to the desired semi-annual yield rate, $\frac{r}{i}$ is 1.03125.
- The present value of the redemption value is 381.50.

Given $v^n = 0.5889$, what is the price of bond X?

(A) 1019 (B) 1029 (C) 1050 (D) 1055 (E) 1072

3. **(2005 Exam FM Sample Questions #30)**
As of 12/31/03, an insurance company has a known obligation to pay $1,000,000 on 12/31/2007. 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 12/31/07. The maturity value of the bond equals the par value.

Under the following reinvestment interest rate movement scenarios effective 1/1/2004, what best describes the insurance company's profit or (loss) as of 12/31/2007 after the liability is paid?

	Interest Rates Drop by ½%	Interest Rates Increase by ½%
(A)	+6,606	+11,147
(B)	(14,757)	+14,418
(C)	(18,911)	+19,185
(D)	(1,313)	+1,323
(E)	Breakeven	Breakeven

4. **(2005 Exam FM Sample Questions #47)**
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%

5. **(2005 Exam FM Sample Questions #50)**
A 1000 bond with semi-annual coupons at $i^{(2)} = 6\%$ matures at par on October 15, 2020. The bond is purchased on June 28, 2005 to yield the investor $i^{(2)} = 7\%$. What is the purchase price?

Assume simple interest between bond coupon dates and note that:

Date	Day of the Year
April 15	105
June 28	179
October 15	288

(A) 906 (B) 907 (C) 908 (D) 919 (E) 925

6. **(2005 Exam FM Sample Questions #54)**
Matt purchased a 20-year par value bond with semiannual coupons at a nominal annual rate of 8% convertible 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 price guarantees that Matt will receive a nominal annual rate of interest convertible semiannually of at least 6%. Calculate X.

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

7. **(2005 Exam FM Sample Questions #55)**
Toby purchased a 20-year par value bond with semiannual coupons at a nominal annual rate of 8% convertible semiannually at a price of 1722.25. The bond can be called at par value 1100 on any coupon date starting at the end of year 15.

What is the minimum yield that Toby could receive, expressed as a nominal annual rate of interest convertible semiannually?

(A) 3.2% (B) 3.3% (C) 3.4% (D) 3.5% (E) 3.6%

8. **(2005 Exam FM Sample Questions #56)**
Sue purchased a 10-year par value bond with semiannual coupons at a nominal annual rate of 4% convertible 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 price guarantees that Sue will receive a nominal annual rate of interest convertible semiannually of at least 6%.

Calculate X.

(A) 1120 (B) 1140 (C) 1160 (D) 1180 (E) 1200

9. **(2005 Exam FM Sample Questions #57)**
Mary purchased a 10-year par value bond with semiannual coupons at a nominal annual rate of 4% convertible semiannually at a price of 1021.50. The bond can be called at par value 1100 on any coupon date starting at the end of year 5.

What is the minimum yield that Mary could receive, expressed as a nominal annual rate of interest convertible semiannually?

(A) 4.8% (B) 4.9% (C) 5.0% (D) 5.1% (E) 5.2%

10. **(May 05 #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

11. **(May 05 #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 10th 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 10th 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%

12. (Nov 05 #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

13. (Nov 05 #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

14. (Nov 05 #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%

15. (Nov 05 #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

16. (Nov 05 #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%