

Exam FM
November 2005

1. An insurance company earned a simple rate of interest of 8% over the last calendar year based on the following information:

Assets, beginning of year	25,000,000
Sales revenue	X
Net investment income	2,000,000
Salaries paid	2,200,000
Other expenses paid	750,000

All cash flows occur at the middle of the year.

Calculate the effective yield rate.

- (A) 7.7%
- (B) 7.8%
- (C) 7.9%
- (D) 8.0%
- (E) 8.1%

2. Calculate the Macaulay duration of an eight-year 100 par value bond with 10% annual coupons and an effective rate of interest equal to 8%.

(A) 4

(B) 5

(C) 6

(D) 7

(E) 8

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

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

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

5. Alex is an investment analyst for a large fund management firm. He specializes in finding risk-free arbitrage opportunities in the stock market.

His strategy consists of selling a specific number of call options for each share of stock selected in the fund.

Which of the following best describes the technique used by Alex to achieve his goal?

- (A) Black Scholes option pricing model
- (B) Capital Asset Pricing Model
- (C) Full immunization
- (D) Short sales
- (E) Hedge ratio

6. Consider a yield curve defined by the following equation:

$$i_k = 0.09 + 0.002k - 0.001k^2$$

where i_k is the annual effective rate of return for zero coupon bonds with maturity of k years.

Let j be the one-year effective rate during year 5 that is implied by this yield curve.

Calculate j .

- (A) 4.7%
- (B) 5.8%
- (C) 6.6%
- (D) 7.5%
- (E) 8.2%

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%

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

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%

10. A company must pay liabilities of 1000 and 2000 at the end of years 1 and 2, respectively. The only investments available to the company are the following two zero-coupon bonds:

Maturity (years)	Effective annual yield	Par
1	10%	1000
2	12%	1000

Determine the cost to the company today to match its liabilities exactly.

- (A) 2007
- (B) 2259
- (C) 2503
- (D) 2756
- (E) 3001

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

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

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%

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

15. You are given the following term structure of spot interest rates:

Term (in years)	Spot interest rate
1	5.00%
2	5.75%
3	6.25%
4	6.50%

A three-year annuity-immediate will be issued a year from now with annual payments of 5000.

Using the forward rates, calculate the present value of this annuity a year from now.

- (A) 13,094
- (B) 13,153
- (C) 13,296
- (D) 13,321
- (E) 13,401

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%

17. Theo sells a stock short with a current price of 25,000 and buys it back for X at the end of 1 year. Governmental regulations require the short seller to deposit margin of 40% at the time of the short sale. The prevailing interest rate is an 8% annual rate, and Theo earns a 25% yield on the transaction.

Calculate X .

- (A) 19,550
- (B) 20,750
- (C) 22,500
- (D) 23,300
- (E) 24,500

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

19. Which of the following statements about zero-coupon bonds are true?

- I. Zero-coupon bonds may be created by separating the coupon payments and redemption values from bonds and selling each of them separately.
- II. The yield rates on stripped Treasuries at any point in time provide an immediate reading of the risk-free yield curve.
- III. The interest rates on the risk-free yield curve are called forward rates.

- (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).

20. The dividends of a common stock are expected to be 1 at the end of each of the next 5 years and 2 for each of the following 5 years. The dividends are expected to grow at a fixed rate of 2% per year thereafter.

Assume an annual effective interest rate of 6%.

Calculate the price of this stock using the dividend discount model.

- (A) 29
- (B) 33
- (C) 37
- (D) 39
- (E) 41

21. Which of the following statements about immunization strategies are true?

- I. To achieve immunization, the convexity of the assets must equal the convexity of the liabilities.
- II. The full immunization technique is designed to work for any change in the interest rate.
- III. The theory of immunization was developed to protect against adverse effects created by changes in interest rates.

- (A) None
- (B) I and II only
- (C) I and III only
- (D) II and III only
- (E) The correct answer is not given by (A), (B), (C), and (D).

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

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

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%

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) $\frac{X}{v^{17} + v^{15} + v^{12}} + \frac{Y}{v^{20} + v^{18} + v^{15}}$
- (B) $3[Xv^{18} + Yv^{21}]$
- (C) $3Xv^3 + Y[v^{20} + v^{18} + v^{15}]$
- (D) $(X + Y)\frac{v^{20} + v^{18} + v^{15}}{v^3}$
- (E) $X[v^{17} + v^{15} + v^{12}] + Y[v^{20} + v^{18} + v^{15}]$

Preliminary Answer Key
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1	D
2	C
3	C
4	D
5	E
6	A
7	D
8	B
9	E
10	C
11	B
12	B
13	A
14	B
15	B
16	C
17	D
18	D
19	E
20	D
21	D
22	B
23	C
24	C
25	E