1. Bruce deposits 100 into a bank account. His account is credited interest at a nominal rate of interest $i$ 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 $\delta$.

After 7.25 years, the value of each account is 200.

Calculate $(i - \delta)$.

(A) 0.12%
(B) 0.23%
(C) 0.31%
(D) 0.39%
(E) 0.47%
2. Suppose the required reserve ratio for commercial banks is 10%. Further suppose that the central bank, through open market operations, purchases 1 billion in U.S. government securities from commercial banks.

As a result of this action, the potential amount of increase in checkable deposits in the banking system will:

(A) increase by 10 billion.
(B) increase by 1.1 billion.
(C) decrease by 0.9 billion.
(D) decrease by 1.1 billion.
(E) decrease by 10 billion.
3. The beta for QRS Life Insurance Company is 0.4, while the beta for the life insurance industry is \( X \). The risk-free rate of interest is 4% and the market return is 14%.

The expected return on QRS stock minus the expected return for the industry is 0.5%.

Calculate \( X \).

(A) \(-0.10\)
(B) \(0.10\)
(C) \(0.25\)
(D) \(0.35\)
(E) \(0.45\)
4. XYZ Company produces paper used to manufacture corrugated boxes. XYZ has available to it a fixed labor force of 2000 person-hours per day, employed under a long-term contract at 10 per hour. It operates with excess machine capacity and can produce paper with a labor allocation of 8 hours per ton of paper. It can deliver paper with a labor allocation of 2 hours per ton of paper delivered. XYZ receives a price for paper of 110 per ton delivered to the corrugated manufacturer.

XYZ is considering a contract with a shipping firm, who would ship all of XYZ’s paper.

Calculate the maximum amount XYZ could pay to subcontract its delivery without reducing profit.

(A) 2000
(B) 4000
(C) 5000
(D) 5500
(E) 7500
5. A machine is purchased for 5000 and has a salvage value of $S$ at the end of 10 years. The machine is depreciated using the sum-of-the-years-digits method.

At the end of year 4, the machine has a book value of 2218. At that time, the depreciation method is changed to the straight-line method for the remaining years.

Determine the new depreciation charge for year 8.

(A) 200
(B) 222
(C) 286
(D) 370
(E) 464
6. An increase in income shifts the demand curve for sailboats.

In the short run, what will be the most likely result of this shift?

(A) Higher prices
(B) Lower prices
(C) An upward shift in the supply curve
(D) A downward shift in the supply curve
(E) A lower output
7. A firm has the following capital structure:

<table>
<thead>
<tr>
<th>Market Value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>5,000</td>
</tr>
<tr>
<td>Equity</td>
<td>10,000</td>
</tr>
<tr>
<td>Total</td>
<td>15,000</td>
</tr>
</tbody>
</table>

Current Share Price: 50
Expected Earnings Per Share (EPS): 6
Cost of New Debt: 5%

The firm would like to issue new debt and use the proceeds to repurchase equity.

Using the assumptions in Modigliani and Miller’s Proposition I, determine the amount of new debt the firm must issue to achieve an expected ROE of 15%.

(A) 2000
(B) 3000
(C) 4000
(D) 5000
(E) 6000
8. 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
9. You are given the following data for Country X:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>200</td>
</tr>
<tr>
<td>Imports</td>
<td>250</td>
</tr>
<tr>
<td>Income received</td>
<td>50</td>
</tr>
<tr>
<td>Income paid</td>
<td>100</td>
</tr>
<tr>
<td>Increase in Country X holdings of foreign assets</td>
<td>350</td>
</tr>
<tr>
<td>Increase in foreign holdings of Country X assets</td>
<td>450</td>
</tr>
</tbody>
</table>

Calculate the Capital Account Balance for Country X.

(A) $-100$

(B) $-50$

(C) $+50$

(D) $+100$

(E) $+200$
10. Consumers view fish and beef as substitutes. Suppose that medical studies show that eating fish substantially reduces the risk of certain types of cancer.

What effects will this information have on the prices of fish and beef and the quantities consumed of each commodity?

(A) The price of fish will decrease, and the quantity of fish consumed will decrease. The price of beef will increase, and the quantity of beef consumed will increase.

(B) The price of fish will decrease, but the quantity of fish consumed will increase. The price of beef will increase, but the quantity of beef consumed will decrease.

(C) The price of fish will increase, and the quantity of fish consumed will increase. The price of beef will decrease, and the quantity of beef consumed will decrease.

(D) The price of fish will increase, but the quantity of fish consumed will decrease. The price of beef will decrease, but the quantity of beef consumed will increase.

(E) The price of fish will increase, and the quantity of fish consumed will increase. The price of beef will increase, but the quantity of beef consumed will decrease.
11. Which of the following statements about portfolio risk are true?

I. The variability of an investment portfolio that is balanced evenly between two stocks is lower than the average variability of the two individual stocks.

II. Full diversification of an investment portfolio eliminates market risk.

III. The total risk of an individual stock held in isolation determines its contribution to the risk of a well-diversified portfolio.

(A) I only

(B) III only

(C) I and II only

(D) II and III only

(E) I, II, and III
12. Eric deposits $X$ into a savings account at time 0, which pays interest at a nominal rate of $i$, compounded semiannually.

Mike deposits $2X$ 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 8\textsuperscript{th} year.

Calculate $i$.

(A) 9.06%  
(B) 9.26%  
(C) 9.46%  
(D) 9.66%  
(E) 9.86%
13. In 1991, the United States switched from using Gross National Product (GNP) to using Gross Domestic Product (GDP) to track the level of economic activity.

Which of the following is true regarding GNP and GDP?

(A) The difference between GNP and GDP is the value of aggregate investment.
(B) Production in the government sector is valued at the cost of its inputs.
(C) The overall level of economic activity can be measured by adding the value of output produced to the level of income earned.
(D) Most other countries use a GNP concept to track economic activity.
(E) GDP is defined as the market value of all final goods and services produced in a given time period by labor and property of U.S. residents, regardless of where the labor and property are located.
14. The supply and demand functions for a competitive industry are:

Demand: \[ P = 20 - 4Q \]

Supply: \[ P = 10 + Q \]

where \( P \) is price and \( Q \) is quantity.

Suppose the incomes of consumers change and the new demand function is:

Demand: \[ P' = 30 - 4Q' \]

Calculate the elasticity of supply in moving from the old to the new equilibrium.

(A) 0.2  
(B) 0.9  
(C) 1.0  
(D) 1.5  
(E) 6.0
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
16. A company is considering purchasing new equipment at a price of 15,000. The purchase would be financed by issuing new common stock that has an underwriting cost of 500. The new equipment is expected to generate cash flows of 2700 at the end of each year for 10 years.

The company's opportunity cost of capital is 12% and its return on equity is 15%.

Determine the company's adjusted present value for this venture.

(A) –1949
(B) –1449
(C) –949
(D) –244
(E) 256
17. An association had a fund balance of 75 on January 1 and 60 on December 31. At the end of every month during the year, the association deposited 10 from membership fees. There were withdrawals of 5 on February 28, 25 on June 30, 80 on October 15, and 35 on October 31.

Calculate the dollar-weighted rate of return for the year.

(A) 9.0%

(B) 9.5%

(C) 10.0%

(D) 10.5%

(E) 11.0%
18. In 2001, the level of output for a country was 1500. The total factor productivity growth is expected to be 10% between 2001 and 2002. The elasticity of output with respect to capital and labor are projected to be 0.8 and 1.2 respectively in 2002.

The table below shows the actual capital and labor inputs for 2001 along with projected inputs for 2002.

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>800</td>
<td>1200</td>
</tr>
<tr>
<td>2002</td>
<td>1000</td>
<td>1100</td>
</tr>
</tbody>
</table>

What is the projected level of output for 2002?

(A) 1250
(B) 1500
(C) 1650
(D) 1800
(E) 1975
19. Suppose an actuary is offered a job with an insurance firm for a salary of 150,000 per year. The job also includes pension and insurance benefits worth 25,000 per year. Further suppose that the actuary chooses instead to open her own consulting firm. Her consulting firm bills 275,000 per year, and it has the following costs: 12,500 for supplies, 20,000 for secretarial support, and 70,000 to lease office space and furniture.

Calculate the actuary’s annual accounting and economic profit from her consulting firm.

(A) Accounting profit = 147,500; Economic profit = −2,500
(B) Accounting profit = 147,500; Economic profit = 22,500
(C) Accounting profit = 172,500; Economic profit = −2,500
(D) Accounting profit = 172,500; Economic profit = 22,500
(E) Accounting profit = 172,500; Economic profit = 277,500
20. Which of the following statements about equity and debt securities are true?

I. United States law allows corporations to issue different classes of common stock with different voting rights.

II. The par value of a company’s common stock (as entered in the company’s books) is generally equal to the amount of money the company receives when first selling the shares to the public.

III. A bond that is both senior and secured does not pose much risk to the investor.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) II and III only
21. Monitoring is a costly economic activity. In order to lower monitoring costs, manufacturing firms can construct labor contracts such that workers will self-monitor their activities. To do this, Firm J offers its workers “efficiency wages” while Firm K offers its workers wages based on number of units produced.

How does the wage rate at each of the two firms compare to the market equilibrium wage rate?

(A) Neither firm pays the market equilibrium wage rate.

(B) Firm J pays above the market equilibrium wage rate, whereas Firm K pays the market equilibrium wage rate.

(C) Firm J pays below the market equilibrium wage rate, whereas Firm K pays the market equilibrium wage rate.

(D) Firm J pays the market equilibrium wage rate, whereas Firm K pays below the market equilibrium wage rate.

(E) Both firms pay the market equilibrium wage rate.
22. 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, \ldots, \( n \) 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
23. You are given the following information about a firm’s expected returns and debt:

\[ r_{\text{assets}} = 11\% \]
\[ r_{\text{debt}} = 7\% \]

Debt = 800
\[ \beta_{\text{equity}} = 0.9 \]

Risk-free rate = 4.5%
Market risk premium = 12.3%

Determine the value of the firm.

(A) 900
(B) 1500
(C) 1720
(D) 3260
(E) 7200
24. The IS and LM curves for the economy of country X are as follows:

\[
\text{IS: } r = 12 - 2Y \\
\text{LM: } r = Y
\]

where \( r \) is the interest rate in percent and \( Y \) is income in trillions.

Now suppose the central bank engages in an expansionary monetary policy while the fiscal authority expands government purchases of goods and services.

According to the IS-LM model, what impact would these policies have?

(A) The new equilibrium interest rate will be less than 4%, and the new equilibrium level of output will be greater than 4 trillion.

(B) The new equilibrium interest rate will be greater than 4%, and the new equilibrium level of output will be greater than 4 trillion.

(C) The new equilibrium interest rate will be less than 4%, but the impact on the equilibrium level of output is ambiguous.

(D) The impact on the equilibrium interest rate is ambiguous, but the new equilibrium level of output will be greater than 4 trillion.

(E) The impact on both the equilibrium interest rate and level of output is ambiguous.
25. Which of the following are real options found in capital investment projects?

I. A call option to make follow-on investments
II. A call option to wait before investing
III. A call option to abandon

(A) I only
(B) II only
(C) I and II only
(D) I and III only
(E) II and III only
26. 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
27. Consider the following forecasted long-run average cost (\( AC \)) curve for a representative firm in a contestable market:

\[
AC = Q + \left( \frac{25}{Q} \right)
\]

Suppose that the market demand function is:

\[
P = 50 - 4Q
\]

where \( P \) is price and \( Q \) is quantity.

How many identical firms will this market support?

(A) 0

(B) 1

(C) 2

(D) 5

(E) 10
28. You are given the following information about a firm:

Proportion of the firm’s book value related to debt: 20%
Proportion of the firm’s book value related to equity: 80%
Expected return on the firm’s debt: 10%
Expected return on the firm’s equity: 15%

\[ \beta_{\text{asset}} = 0.78 \]
\[ \beta_{\text{debt}} = 0.30 \]
\[ \beta_{\text{equity}} = 1.50 \]

Calculate the firm’s cost of capital.

(A) 11%
(B) 12%
(C) 13%
(D) 14%
(E) 15%
29. Suppose that the quantity theory of money is an adequate description of the economy. Further suppose that velocity rises at 2% per year and output increases by 4%. Let $M$ denote the rate of change in the money supply.

Determine the values of $M$ that will keep inflation between 1% and 2% per year.

(A) $-1\% \leq M \leq 0\%$
(B) $0\% \leq M \leq 1\%$
(C) $1\% \leq M \leq 2\%$
(D) $2\% \leq M \leq 3\%$
(E) $3\% \leq M \leq 4\%$
30. You are given the following table of interest rates:

<table>
<thead>
<tr>
<th>Calendar Year of Original Investment</th>
<th>Investment Year Rates (in %)</th>
<th>Portfolio Rates (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$i_1$</td>
<td>$i_2$</td>
</tr>
<tr>
<td>1992</td>
<td>8.25</td>
<td>8.25</td>
</tr>
<tr>
<td>1993</td>
<td>8.5</td>
<td>8.7</td>
</tr>
<tr>
<td>1994</td>
<td>9.0</td>
<td>9.0</td>
</tr>
<tr>
<td>1995</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td>1997</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>1998</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>1999</td>
<td>10.0</td>
<td>9.8</td>
</tr>
<tr>
<td>2000</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>2001</td>
<td>9.0</td>
<td></td>
</tr>
</tbody>
</table>

A person deposits 1000 on January 1, 1997. Let the following be the accumulated value of the 1000 on January 1, 2000:

- $P$: under the investment year method
- $Q$: under the portfolio yield method
- $R$: where the balance is withdrawn at the end of every year and is reinvested at the new money rate

Determine the ranking of $P$, $Q$, and $R$.

(A) $P > Q > R$

(B) $P > R > Q$

(C) $Q > P > R$

(D) $R > P > Q$

(E) $R > Q > P$
31. Which of the following are advantages of Arbitrage Pricing Theory (APT) over the Capital Asset Pricing Model?

I. APT does not need a market portfolio.
II. The risk factors are dictated by the design of APT.
III. APT has a simpler mathematical structure.

(A) I only
(B) II only
(C) I and II only
(D) I and III only
(E) II and III only
32. Suppose that a consumer’s income decreases and, at the same time, the price of X decreases. Further suppose that a consumer purchases less X than he did at the previous price and income levels.

Given the observed change in consumption in response to the price and income changes, which of the following is true?

(A) X must be a normal good.
(B) X must be a non-Giffen inferior good.
(C) X must be a Giffen good.
(D) X could be either normal or non-Giffen inferior.
(E) X could be either normal or Giffen.
33. At an annual effective interest rate of \( i, i > 0 \), both of the following annuities have a present value of \( X \):

(i) a 20-year annuity-immediate with annual payments of 55

(ii) a 30-year annuity-immediate with annual payments that pays 30 per year for the first 10 years, 60 per year for the second 10 years, and 90 per year for the final 10 years

Calculate \( X \).

(A) 575  
(B) 585  
(C) 595  
(D) 605  
(E) 615
You are given:

(i) Personal tax rate on interest \( T_p = 38\% \).

(ii) Effective personal tax rate on equity income \( T_{pe} = 38\% \).

(iii) Tax rate on capital gains = 28\%.

(iv) Corporate tax rate = 35\%.

Determine the relative tax advantage of debt, using the Modigliani and Miller model.

(A) 1.00
(B) 1.32
(C) 1.39
(D) 1.54
(E) 1.69
35. Which of the following statements about common goods and public property are true?

I. Private markets fail to produce nonexcludable goods in socially efficient quantities because of the free riding problem.

II. An admission fee to discourage overuse of common property is a form of Pigou tax.

III. A Clarke tax produces information about the value that the public places on a public good.

(A) II only
(B) I and II only
(C) I and III only
(D) II and III only
(E) I, II, and III
36. Eric and Jason each sell a different stock short at the beginning of the year for a price of 800. The margin requirement for each investor is 50% and each will earn an annual effective interest rate of 8% on his margin account.

Each stock pays a dividend of 16 at the end of the year. Immediately thereafter, Eric buys back his stock at a price of \((800 - 2X)\), and Jason buys back his stock at a price of \((800 + X)\).

Eric’s annual effective yield, \(i\), on the short sale is twice Jason’s annual effective yield. Calculate \(i\).

(A) 4%
(B) 6%
(C) 8%
(D) 10%
(E) 12%
37. A company’s dividend per share is expected to grow indefinitely at a rate of 6% per year. Suppose the current stock price is 600 and the next annual dividend, payable one year from now, is 20. Assume that the opportunity cost of capital is constant.

John, Bill, and Fred each invest in the company. John invests for one year, Bill invests for two years, and Fred invests for three years.

Who expects the highest annualized rate of return?

(A) John
(B) Bill
(C) Fred
(D) John, Bill, and Fred all have the same expected rate of return.
(E) Not enough information is given here to answer the question.
Suppose that the central bank is targeting real output growth. Further suppose that the central bank has decided to lower the discount rate.

What does this information suggest about the business cycle and the actions taken on the part of the central bank?

(A) The economy is in a contractionary phase of the business cycle, and the central bank would be purchasing bonds through open market operations.

(B) The economy is in a contractionary phase of the business cycle, and the central bank would be raising the required reserve ratio.

(C) The economy is in a contractionary phase of the business cycle, and the central bank would be selling bonds on the open market.

(D) The economy is in an expansionary phase of the business cycle, and the central bank would be purchasing bonds through open market operations.

(E) The economy is in an expansionary phase of the business cycle, and the central bank would be selling bonds on the open market.
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
40. You are interested in purchasing a call option on a common stock that is currently trading at a price of 122 per share. You are given the following information:

(i) the standard deviation of the continuously compounded annual rate of return on the stock is 0.2

(ii) the time to maturity of the call is 1 year

(iii) \( \ln\left(\frac{\text{Current Stock Price}}{\text{Present Value of the Exercise Price}}\right) = 0.2 \)

Calculate the price of each call option using Black-Scholes.

(A) 13

(B) 15

(C) 19

(D) 21

(E) 24
41. Suppose X is exchanged in a competitive market, and the supply and demand functions for X are as follows:

Supply: \[ Q = 25 + 5P \]
Demand: \[ Q = 100 - 5P \]

where \( P \) is price and \( Q \) is quantity.

Now suppose that an excise tax of 5.0 per unit is placed on sales of X.

How much tax revenue will be raised in this market?

(A) 125.0  
(B) 187.5  
(C) 250.0  
(D) 312.5  
(E) 375.0
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 7th coupon.

(A) 632
(B) 642
(C) 651
(D) 660
(E) 667
43. Which of the following statements about efficient markets are true?

I. In the strong form of the efficient market theory, prices reflect all public information.

II. In an efficient market, a portfolio manager is not expected to consistently outperform the market.

III. In the weak form of the efficient market theory, prices reflect all information contained in the record of past prices.

(A) I only
(B) I and II only
(C) I and III only
(D) II and III only
(E) I, II, and III
A product is offered in a perfectly competitive market. The market supply and demand functions for the product are as follows:

\[
\text{Supply:} \quad P = 10 + Q \\
\text{Demand:} \quad P = 5 - Q
\]

where \( P \) is price and \( Q \) is quantity.

The industry for this product is composed of 100 identical firms, each with the following marginal cost function and no fixed costs:

\[
MC = 10 + 100q
\]

where \( MC \) is marginal cost, and \( q \) is the quantity produced by the firm.

Calculate the output for the typical firm.

(A) 0  
(B) 1  
(C) 2  
(D) 3  
(E) 5
45. 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 $Y$.

(A) 110
(B) 120
(C) 130
(D) 140
(E) 150
46. A company’s inventory has risen by 100,000 over the last quarter, but its other current assets have remained constant. Its current liabilities have also remained the same over the last quarter.

How will its current ratio and quick ratio change from the previous quarter?

(A) Both will go up.
(B) Both will go down.
(C) Neither ratio will change.
(D) The current ratio goes up, but the quick ratio goes down.
(E) The current ratio goes up, but the quick ratio does not change.
47. Suppose that the federal authorities of country X control the central bank and adhere to a fixed exchange rate policy. Further suppose that the authorities choose to put downward pressure on interest rates and simultaneously depreciate the exchange rate.

What effect will these policies have on the components of aggregate demand in the Keynesian model?

(A) Investment will increase, but net exports will decrease.

(B) Investment will increase, and net exports will increase.

(C) Investment will decrease, and net exports will decrease.

(D) Investment will decrease, but net exports will increase.

(E) The impact on investment is ambiguous, and the impact on net exports is ambiguous.
48. The price elasticity of demand for X is $-0.75$. Due to an increase in the cost of producing X, the equilibrium price of X increases by 3%.

Calculate the percentage change in the quantity of X exchanged in the market.

(A) $-4.00\%$

(B) $-2.25\%$

(C) $-0.25\%$

(D) $+2.25\%$

(E) $+4.00\%$
49. Which of the following statements about capital structure are true?

I. According to Lintner’s model, managers focus more on the absolute levels of dividends than on dividend changes.

II. According to Modigliani and Miller, in a perfect world, a company’s dividend policy is irrelevant.

III. A company that repurchases shares is typically optimistic about the future.

(A) II only

(B) I and II only

(C) I and III only

(D) II and III only

(E) I, II, and III
50. 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%
Course 2
May 2003
Preliminary Answer Key

2. A  27. C
3. D  28. B
4. D  29. E
5. C  30. D
6. A  31. A
7. B  32. E
8. E  33. A
9. D  34. D
10. C  35. E
11. A  36. B
12. C  37. D
13. B  38. A
14. E  39. D
15. A  40. E
16. D  41. C
17. E  42. B
18. D  43. E
19. C  44. A
20. A  45. C
22. C  47. B
24. D  49. D
25. C  50. C
Course 2
May 2003
Answer Key

2. A   27. C
3. D   28. B
4. D   29. E
5. C   30. D
6. A   31. A
7. B   32. E
8. E   33. A
9. D   34. D
10. C  35. C&E
11. A  36. B
12. C  37. D
13. B  38. A
14. E  39. D
15. A  40. E
16. D  41. C
17. E  42. B
18. D  43. E
19. C  44. A
20. A  45. C
22. C  47. A&B
24. D  49. D
25. C  50. C
1. Solution: B

For Bruce: \(\left(1 + \frac{i}{2}\right)^{7.25(2)} = \left(1 + \frac{i}{2}\right)^{14.5} = 2 \Rightarrow i = 9.79\%
\)

For Peter: \(e^{7.25} = 2;\)
\[\delta = \frac{\ln 2}{7.25} = 9.56\%
\]
\[\therefore (i - \delta) = 9.79\% - 9.56\% = 0.23\%
\]

2. Solution: A

The increase in checkable deposits equals the increase in reserves divided by the required reserve ratio. 1 billion/0.10 = 10 billion

3. Solution: D

\[0.4(0.1) - X(0.1) = 0.005
\]
\[0.04 - 0.005 = X(0.1)
\]
\[X = 0.35 .
\]
4. Solution: D

Before delivery is outsourced, XYZ can produce 200 tons of paper per day, calculated as
2000 hours × (8/10)/8 hours per ton = 200, where 8/10 represents the percentage of
hours that must be devoted to manufacturing.

After outsourcing delivery, XYZ can produce 250(= 200/8) tons per day.
The difference in revenue is 5500(= 50×110).

5. Solution: C

\[
(5000 - x) \times \frac{10 + 9 + 8 + 7}{55} = (5000 - 2218) \\
x = 500 \\
\frac{2218 - 500}{6} = 286.33
\]

6. Solution: A

An increase in income shifts the demand curve upward, which raises output and prices.

7. Solution: B

Current ROE = 6/50 = 12%
# shares outstanding = 10,000/50 = 200
Total expected earnings = 200(6) = 1200
Define D = amount of new debt
Then \((1200 - 0.5 D)/(10,000 - D) = 15\%\). Thus D = 3000
8. Solution: E

\[
\text{End of year } 40 = 100 \cdot \frac{s_{40}^m}{a_{41}^m} = X
\]

\[
\text{End of year } 20 = 100 \cdot \frac{s_{20}^m}{a_{21}^m}
\]

\[
100 \cdot \frac{s_{20}^m}{a_{21}^m} = 100s_{20}^m \left(\frac{(1+i)^{20} + 1}{a_{21}^m}\right) = 100 \cdot s_{20}^m \quad (5)
\]

\[
(1+i)^{20} = 4 \Rightarrow i = 7.1773\%
\]

\[
X = 100 \cdot \frac{s_{40}^m}{a_{41}^m} = 6195
\]
11. Solution: A

I. is true.
Diversification reduces variability by lowering unique risk.

12. Solution: C

Eric’s interest, last 6 months: \( X \left(1 + \frac{i}{2}\right)^{15} \cdot \left(1 + \frac{i}{2} - 1\right) \)

\[= X \left(1 + \frac{i}{2}\right)^{15} \cdot \frac{i}{2}\]

Mike’s interest, last 6 months: \( 2X \cdot \frac{i}{2} \)

\[\therefore X \left(1 + \frac{i}{2}\right)^{15} \cdot \frac{i}{2} = 2X \cdot \frac{i}{2} \Rightarrow \left(1 + \frac{i}{2}\right)^{15} = 2 \Rightarrow i = 9.46\%\]

13. Solution: B

It is not possible to value government sector output at its market price because there is not a marketplace where these goods and services are sold. Therefore, production in the government sector is valued at the cost of its inputs.

14. Solution: E

By definition, the elasticity of supply is \((dQ/dP) \times (P/Q)\). Substitution yields:

\[1 \times (12/2) = 6.\]
15. Solution: A

\[ a_{[m]} = 6.14457 \]

The payment using the amortization method \( = \frac{10,000}{6.14457} = 162.745 \) .

The interest \( = 1000 \times 0.1 = 100 \)

Deposits into the sinking fund \( = 162.745 - 100 = 62.745 \)

\[ s_{10|0.14} = 19.3373 \]

\[ 62.745 \times 19.3373 = 1213.319 \]

\[ 1213.319 - 1000 = 213.319 \]

16. Solution: D

\[
\text{NPV} = -15,000 \text{ initially and } 2,700 \text{ for 10 years @ 12}\% \\
= +255.602
\]

\[
\text{APV} = +255.602 \text{ minus underwriting costs of 500 } = -244.398
\]

(or \( \text{NPV} = \text{APV} = -15,500 \text{ initially and } +2,700 \text{ for 10 years @12}\% \))

17. Solution: E

Total deposits \( = 120 \)

Total withdrawals \( = 145 \)

Investment income \( = 60 + 145 - 120 - 75 = 10 \)

Rate of return \( = \frac{10}{75 + \left( \frac{1}{12} + \cdots + \frac{11}{12} \right) \cdot 10 - \left( \frac{10}{12} \right) - \left( \frac{5}{12} \right) - \left( \frac{2.5}{12} \right) - \left( \frac{80}{12} \right) - \left( \frac{2}{12} \right) - \left( \frac{35}{12} \right) } \)

\[ = 10/90.833 = 11\% \]
18. Solution: D
\[ \frac{\Delta Y}{Y} = \alpha_k \frac{\Delta K}{K} + \alpha_n \frac{\Delta N}{N} + \frac{\Delta A}{A} \]
\[\frac{Y - 1500}{1500} = 0.8 \times \frac{(1000 - 800)}{800} + 1.2 \times \frac{(1100 - 1200)}{1200} + 0.10 = 0.20\]
\[\Rightarrow Y = 1500 \times (1.2) = 1800\]

19. Solution: C
Accounting profit is total revenue less accounting costs:
\[275,000 - 12,500 - 20,000 - 70,000 = 172,500\]
Economic profit is total revenue less accounting costs less opportunity costs. Hence economic profit is \(275,000 - 102,500 - 175,000 = -2,500\).

20. Solution: A
I is true.
II is false because in general, the par value of common stock is set very low, often at $1.
III is false because the risk is a function of the riskyness of the issuing firm’s assets. A bond secured by risky assets is still risky.

21. Solution: B
Efficiency wages are above equilibrium in order to induce workers to self-monitor; however, since they are above equilibrium, there are more workers seeking work at the efficiency rate than there are jobs at that rate. Workers working for a rate based on production receive their marginal products—i.e. the equilibrium wage—and since they only get paid for what they do, they self-monitor.
22. Solution: C

Cost of the perpetuity = \( v \cdot (\frac{1}{i}) + \frac{n \cdot v^{n+1}}{i} \)

\[
= v \left[ \frac{a_n}{i} - n v^n \right] + \frac{n \cdot v^{n+1}}{i} \\
= \frac{a_n}{i} - n v^n \left[ \frac{1}{i} \right] + \frac{n \cdot v^{n+1}}{i} \\
= \frac{a_n}{i}
\]

Since \( i = 10.5\% \),

\[
\frac{a_n}{i} = \frac{a_n}{0.105} = 77.10 \Rightarrow a_n = 8.0955, \text{ at } 10.5\
\]

\[ \therefore n = 19 \]

23. Solution: B

\[ r_{\text{equity}} = r_t + \beta_{\text{equity}} \text{ (market risk premium)} = 4.5\% + 0.9(12.3\%) = 15.57\% \]

\[ r_{\text{assets}} = X \cdot r_{\text{debt}} + (1 - X) \cdot r_{\text{equity}} \]

\[ 11\% = X \cdot 7\% + (1 - X) \cdot 15.57\% \]

\[-4.57\% = -8.57\% \cdot X \]

\[ X = 0.533 \]

\[ X = \frac{D}{V}; \quad X = 0.533 = \frac{800}{V}; \quad V = 1500 \]

24. Solution: D

An expansionary monetary policy will shift the LM curve to the right – i.e. it will decrease the R intercept in the LM function. An expansionary fiscal policy will shift the IS curve to the right – i.e. it will increase the R intercept in the IS function. Together, these two policies will unambiguously increase output, but the impact on interest rates is ambiguous.
25. Solution:  

I and II are real options.
Statement III is false—an option to abandon is a put option, not a call option

26. Solution:  

\[
6(Ds)_{10\%} + 100 \overline{s}_{10\%} \\
6 \left( \frac{10(1.09)^{10} - \overline{s}_{10\%}}{0.09} \right) + 100(15.19293) \\
565.38 + 1519.29 \\
2084.67
\]

27. Solution:  

In a contestable market, the minimum point of the average cost function corresponds with price in the long run; therefore price will equal 10, and the representative firm will produce 5 units. However, at a price of 10, the quantity demanded is 10; so this market can support two identical firms.

28. Solution:  

The split of the firm’s market value between debt and equity is determined using the beta data.

\[ \beta_{asset} = \beta_{debt} \times \text{deb proportion of value} + \beta_{equity} \times \text{equity proportion of value}, \]

where the debt and equity weights equal 1.0. This yields a debt weight of 60% and an equity weight of 40%.

Then the expected returns for the debt and equity components are weighted to yield the cost of capital. Thus, 0.60*0.10 + 0.40*0.15 = 0.12.
29. Solution: E

The quantity theory of money states that \( \% \) change in money (M) + \% change Velocity (V) = \% change in prices (P) + \% change in output (Y). \( Y = 4, V = 2 \) and \( 1 \leq P \leq 2 \). Hence, \( 3 \leq M \leq 4 \).

30. Solution: D

\[
P = 1000(1.095)(1.095)(1.096) = 1314.13
\]

\[
Q = 1000(1.0835)(1.086)(1.0885) = 1280.82
\]

\[
R = 1000(1.095)(1.10)(1.10) = 1324.95
\]

Thus, \( R > P > Q \).

31. Solution: A

I. True
II. Risk factors are ad hoc.
III. CAPM is simpler.

32. Solution: E

We cannot rule out that X is Giffen: the effect of the price decrease for a Giffen good is to decrease consumption and the effect of the decrease in income is to increase consumption (because a Giffen good is inferior). It is possible that the negative effect of the price decrease would outweigh the positive effect of the income decrease.

We cannot rule out the possibility that X is normal: the effect of the price reduction would be to increase consumption and the effect of the income decrease would be to decrease consumption and the effect of the income decrease could outweigh the effect of the price decrease.

We can rule out the possibility that X is non-Giffen inferior because, in that case, the total effect of the price reduction would be to increase consumption and the effect of the income decrease would also be to increase consumption. The question indicates consumption decreases.
33. Solution: A

\[30 \cdot a_{\text{m}} + 60 \cdot v^{10} \cdot a_{\text{m}} + 90 \cdot v^{20} \cdot a_{\text{m}} =\]
\[a_{\text{m}} \left[ 30 + 60v^{10} + 90v^{20} \right] = 55a_{20\%} = 55 \cdot a_{\text{m}} (1 + v^{10})\]
\[90v^{20} + 5v^{10} - 25 = 0\]
\[v^{10} = -5 \pm \sqrt{25 + 9000} \approx \frac{90}{180} = 0.5\]
\[\therefore i = 7.18\%\]
\[x = 55 \cdot a_{20\%:18} = 574.60\]

34. Solution: D

\[1 - T_p \]
\[\frac{1 - 0.38}{(1 - T_{p})(1 - T_c)} = \frac{(1 - 0.38)(1 - 0.35)}{(1 - 0.38)(1 - 0.35)} = 1.538\]

35. Solution: E

I. True, Landsburg, p. 500
II. True, Landsburg, pp. 491-492
III. True, Landsburg, p. 505
36. Solution: B

Eric's profit = \(2X + 32 - 16 = 16 + 2X\)

Jason's profit = \(-X + 32 - 16 = 16 - X\)

Margin = 400 for both Eric and Jason

\[
\text{Yield} = \frac{16 + 2X}{400} = 2 \left(\frac{16 - X}{400}\right)
\]

\(X = 4\)

Yield: \(\frac{16 + 2(4)}{400} = 6\%\)

37. Solution: D

The company’s forecasted dividends and prices grow as follows:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividend</td>
<td>20</td>
<td>21.20</td>
<td>22.47</td>
</tr>
<tr>
<td>Price</td>
<td>636</td>
<td>674</td>
<td>714</td>
</tr>
</tbody>
</table>

Calculate the expected rate of return:

From year 0 to year 1: \(\frac{20 + (636 - 600)}{600} = 0.093\)

From year 1 to year 2: \(\frac{21.20 + (674 - 636)}{636} = 0.093\)

From year 2 to year 3: \(\frac{22.47 + (714 - 674)}{674} = 0.093\)

38. Solution: A

If the central bank is targeting real output growth, and if the central bank is putting downward pressure on the discount rate, then that suggests that the economy is growing at a rate that is below the target rate, and in order to achieve the objective the central bank would buy bonds on the open market.
39. Solution: D

Since the first ten payments equal the annual interest due, the amount outstanding at the end of 10 years is the amount of loan: 1000. For the next 10 years, each payment equals 150% of interest due. The lender charges 10%, therefore 5% of the principal outstanding will be used to reduce the principal.

At the end of 20 years, the amount outstanding is \(1000(1-0.05)^{10} = 598.74\)

\[
\frac{598.74}{a_{10|10\%}} = 97.4417
\]

40. Solution: E

Use Black-Scholes formula:

Value of call option \(= \frac{N(d_1) \times P}{} - \frac{N(d_2) \times PV(EX)}{}\)

\(P = 122\)
\(\sigma = 0.2\)
\(t = 1\)

\[ln \left( \frac{P}{PV(EX)} \right) = 0.2 \Rightarrow PV(EX) = \frac{P}{e^{0.2}} = 99.89\]

\[d_1 = \frac{\ln \left( \frac{P}{PV(EX)} \right)}{\sigma \sqrt{t}} + \frac{\sigma \sqrt{t}}{2} = \frac{0.2}{0.2} + \frac{0.2 \sqrt{1}}{2} = 1.0 + 0.1 = 1.1\]

From Normal table, \(N(1.1) = 0.8643\)

\[d_2 = d_1 - \sigma \sqrt{t} = 1.1 - 0.2 \sqrt{1} = 0.9\]

\[N(0.9) = 0.8159\]

Value of call option \(= (0.8643)(122) - (0.8159)(99.89) = 23.95 \approx 24\)
41. Solution: C

The supply curve can be written as: \( P = \frac{1}{5} Q - 5 \). Adjusting for the tax of 5, \( P = \frac{1}{5} Q \) or \( Q = 5P \). Thus \( P = 10 \) and \( Q = 50 \). Then the tax revenue is 5 \times 50 = 250 \.

42. Solution: B

\( i = 6\% \)

\( BV_6 = 10,000v^d + 800\sigma_{\eta,0.06} = 7920.94 + 2772.08 = 10,693 \)

\( I_7 = i \times BV_6 = 0.06 \times 10,693 = 641.58 \)

43. Solution: E

I is true since the strong form is broader than the semi-strong form.
II is true—the fact that portfolio managers can’t consistently outperform the market is an indication that the market is efficient.
III is true by definition.

44. Solution: A

There is not a market for everything. In this case the supply function lies everywhere above the demand function; hence the quantity of output in this industry is zero.
45. Solution: C

\[
\frac{100}{0.08} = 1250 \\
1250 = X\left[ v + 1.08v^2 + \cdots + 1.08^{24}v^{25} \right] \\
\quad = 25Xv \\
54 = X \\
\frac{Y}{0.08} = 54\left[ 1.08^{10}v + 1.08^{11}v^2 + \cdots + 1.08^{24}v^{15} \right] \\
\quad = 54(1.08)^9[15] \\
Y = 129.5
\]

46. Solution: E

Current ratio = Current assets/Current liabilities
Quick ratio = (Cash + Short-term securities + Receivables)/Current liabilities
Quick ratio does not involve inventories, so it will not change, since inventories is a current asset, increase in inventories will cause the current ratio to go up.

47. Solution: B

The expansionary policy puts downward pressure on both interest rates and the exchange rate. The impact of the former is an increase in investment; the impact of the latter is an increase in net exports as the price of domestic goods falls relative to foreign goods.

48. Solution: B

The calculation of the percentage change in quantity exchanged follows from the definition of price elasticity of demand – i.e., percentage change in quantity demanded divided by percentage change in price. If price increases by 3%, then it must be the case that the quantity exchanged will fall by 2.25%.
49. Solution: D

I. is false. Managers focus more on dividend changes than on absolute levels.

50. Solution: C

\[
10\left(1 - \frac{d}{4}\right)^{-40} (1.03)^{40} + 20(1.03)^{30} = 100
\]

\[
10\left(1 - \frac{d}{4}\right)^{-40} = 15.77
\]

\[
1 - \frac{d}{4} = 0.98867052
\]

\[
\therefore d = 0.0453
\]