

**LO.a: Interpret interest rates as required rates of return, discount rates, or opportunity costs.**

1. The minimum rate of return that an investor must receive in order to invest in a project is *most likely* known as the:
  - A. required rate of return.
  - B. real risk free interest rate.
  - C. inflation rate.
2. Which of the following is *least likely* to be an accurate interpretation of interest rates?
  - A. The rate needed to calculate present value.
  - B. Opportunity cost.
  - C. The maximum rate of return an investor must receive to accept an investment.

**LO.b: Explain an interest rate as the sum of a real risk-free rate, and premiums that compensate investors for bearing distinct types of risk.**

3. Given below is information about a security whose nominal interest rate is 15%:
  - The real risk free rate of return is 3.5%
  - The default risk premium is 3%
  - The maturity risk premium 4%
  - The liquidity risk premium is 2%An investor wants to determine the inflation premium in the security's return. The inflation premium is *closest* to:
  - A. 2.5%.
  - B. 4.0%.
  - C. 9.0%.
4. Two bonds, a U.S. Treasury bond has a yield to maturity of 5 percent, while a bond issued by an industrial corporation, has a yield to maturity of 7 percent. The two bonds are otherwise identical i.e. they have the same maturity, and are option-free. The *most likely* explanation for the difference in yields of the two bonds is:
  - A. Default risk premium.
  - B. Inflation premium.
  - C. Real risk-free interest rate.
5. The maturity premium can be *best* described as compensation to investors for the:
  - A. risk of loss relative to an investment's fair value if the investment needs to be converted to cash quickly.
  - B. increased sensitivity of the market value of debt to a change in market interest rates as maturity is extended.
  - C. possibility that the borrower will fail to make a promised payment at the contracted time and in the contracted amount.

6. Liquidity premium can be best described as compensation to investors for:
- inability to sell a security at its fair market value.
  - locking funds for longer durations.
  - a risk that investment's value may change over time.
7. Following information is given about interest rate:  
 Nominal rate: 20%  
 Real risk free rate: 5%  
 Inflation premium: 4%  
 If the risk premium incorporates default risk, liquidity risk, and any maturity premium, the risk premium is *closest* to:
- 20%.
  - 15%.
  - 11%.
8. You are estimating the required rate of return for a particular investment. Which of the following premiums are you *least likely* to consider?
- Inflation premium.
  - Maturity premium.
  - Nominal premium.

**LO.c: Calculate and interpret the effective annual rate, given the stated annual interest rate and the frequency of compounding.**

9. Camilla wishes to compute the effective annual rate of a financial instrument with stated annual rate of 22% and compounded on a quarterly basis? Which of the following is *most likely* to be closest to the effective annual rate?
- 23%.
  - 24%.
  - 25%.
10. The nominal annual interest rate on a mortgage is 7%. The effective annual rate on that mortgage is 7.18%. The frequency of compounding is *most likely*:
- semi-annual.
  - quarterly.
  - monthly.
11. Which of the three alternative one-year certificates of deposit (CD) shown below has the *highest* effective annual rate (EAR)?

|     | Compounding frequency | Annual interest rate |
|-----|-----------------------|----------------------|
| CD1 | Monthly               | 8.20%                |
| CD2 | Quarterly             | 8.25%                |
| CD3 | Continuously          | 8.00%                |

- A. CD1.
  - B. CD2.
  - C. CD3.
12. If the stated annual interest rate is 11% and the frequency of compounding is daily, the effective annual rate is *closest* to:
- A. 11.00%.
  - B. 11.57%.
  - C. 11.63%.
13. A fixed income instrument with a stated annual interest rate of 18% and offers monthly compounding has an effective annual rate (EAR) *closest* to:
- A. 18.00%.
  - B. 19.56%.
  - C. 20.12%.
14. An investment earns an annual interest rate of 12 percent compounded quarterly. What is the effective annual rate?
- A. 3.00%.
  - B. 12.00%.
  - C. 12.55%.
15. Which of the following continuously compounded rates corresponds to an effective annual rate of 7.45 percent?
- A. 7.19%.
  - B. 7.47%.
  - C. 7.73%.
16. Canadian Foods recorded an operating profit of \$2.568 million and \$5.229 million for 2008 and 2012 respectively. What was the compounded annual rate of growth of Canadian Foods' operating profits during the 2008-2012 period?
- A. 16.30%.
  - B. 18.50%.
  - C. 19.50%.
17. In 2009, Bata had 81 shoe outlets across the country. But, by 2012, the company had to shut down 14 outlets. Which of the following *most likely* represents the growth rate of the number of outlets during this period?
- A. -6.10%.
  - B. -4.63%.
  - C. 6.53%.

**LO.d: Solve time value of money problems for different frequencies of compounding.**

18. How much amount should an investor deposit in an account earning a continuously compounded interest rate of 8% for a period of 5 years so as to earn \$2,238?
- A. \$1500.
  - B. \$1523.
  - C. \$1541.
19. The present value of \$10,000 to be received five years from today, assuming a discount rate of 9% compounded monthly, is *closest* to:
- A. \$6,387.
  - B. \$6,499.
  - C. \$6,897.
20. An investor deposits £1,000 into an account that pays continuously compounded interest of 9% (nominal annual rate). The value of the account at the end of six years is *closest* to:
- A. £1,677.
  - B. £1,712.
  - C. £1,716.
21. Your client invests \$2 million in a security that matures in 4 years and pays 7.5 percent annual interest rate compounded annually. Assuming no interim cash flows, which of the following will *most likely* be the value of the investment at maturity?
- A. \$2.150 million.
  - B. \$2.600 million.
  - C. \$2.671 million.
22. Your client deposits \$5 million in a savings account that pays 5 percent per year compounded quarterly. What will be the value of this deposit after 2.5 years?
- A. \$5.625 million.
  - B. \$5.649 million.
  - C. \$5.661 million.
23. Grim Smith plans to invest ¥12 million, three years from now. The rate of return has been estimated at 8 percent per year. What is the future value of this investment 11 years from now?
- A. ¥22.21 million.
  - B. ¥27.98 million.
  - C. ¥35.25 million.
24. A three-year CD offers a stated annual interest rate of 10 percent compounded quarterly. Given an initial investment of \$80,000, which of the following is *most likely* to be the value of the CD at maturity?
- A. \$86,151.
  - B. \$86,628.
  - C. \$107,591.

25. Donald Trump invests \$3 million in a bank that promises to pay 4 percent annual interest rate compounded daily. Assuming 365 days in a year, what will be the value of Donald's investment at the end of one year?
- A. \$3.003 million.
  - B. \$3.122 million.
  - C. \$3.562 million.
26. You invest \$50,000 for three years that will earn 3.6 percent compounded continuously. What will be the value of your investment after three years?
- A. \$51,832.
  - B. \$55,702.
  - C. \$55,596.
27. Which of the following is *most likely* to increase as the frequency of compounding increases?
- A. Interest rate.
  - B. Present value.
  - C. Future value.
28. How long will it take an investment of \$2,500 to grow three times in value to \$7,500? Assume that the interest rate is 6 percent per year compounded annually.
- A. 11.9 years.
  - B. 18.9 years.
  - C. 21.3 years.
29. Evan Hubbard estimates he needs \$100,000 to travel around the world. He plans to deposit \$800 every month starting one month from today to meet this goal. The interest rate is 7 percent compounded monthly. How many months will it take for Hubbard to achieve his goal?
- A. 95 months.
  - B. 225 months.
  - C. 250 months.

**LO.e: Calculate and interpret the future value (FV) and present value (PV) of a single sum of money, an ordinary annuity, an annuity due, a perpetuity (PV only), and a series of unequal cash flows.**

30. A security pays \$2500 at the start of each quarter for 3 years. Given that the annual discount rate compounded quarterly is 8%, which of the following is *most likely* to be the worth of the security today?
- A. \$18,840.
  - B. \$26,438.
  - C. \$26,967.

31. Ms. Clara Johnson is buying a house. She expects her budget to allow a monthly payment of \$1500 on a 25-year mortgage with an annual interest rate of 6.8 percent. If Johnson makes a 10 percent down payment, the most she can pay for the house is *closest* to:
- A. \$216,116.
  - B. \$240,129.
  - C. \$264,706.
32. A paper supplier forecasts outgoing payments of amount \$360, \$550, and \$400 at the end of months January, February, and March respectively. Assuming today is 1<sup>st</sup> January, and the annual interest rate is 2.4 percent, the minimum amount of money needed in an account today to satisfy these future payments is *closest* to:
- A. \$1,287.
  - B. \$1,305.
  - C. \$1,396.
33. A tenant pays rent of \$1,200 monthly due on the first day of every month. If the annual interest rate is 8 percent, the present value of a full year's rent is *closest* to:
- A. \$13,333.
  - B. \$13,795.
  - C. \$13,887.
34. Chen Xiu wants to buy a house for which he needs to borrow \$200,000. If he takes out a 30-year fixed rate 6% mortgage, his scheduled monthly payments will be *closest* to:
- A. \$556.
  - B. \$1,000.
  - C. \$1,199.
35. Ms. Ling purchases an automobile using a loan. The amount borrowed is €44,000 and the terms of the loan call for the loan to be repaid over seven years using equal monthly payments with an annual nominal interest rate of 12% and monthly compounding. The monthly payment is *closest* to:
- A. €776.72.
  - B. €803.43.
  - C. €923.13.
36. A consumer takes out a loan with monthly payments of €500 for a period of four years with first payment made today. Assuming an annual discount rate of 3.5%, compounded monthly, the present value of the loan is *closest* to:
- A. €22,038.74.
  - B. €22,365.36.
  - C. €22,430.59.
37. Andy Roberts is planning for his retirement and hopes to spend €70,000 per year for an anticipated 30 years in retirement. If he deposits €8,000 at the end of his working years and

the interest rate is assumed to be 5% compounded annually, what is the *minimum* number of deposits he will need to make to fund his desired retirement?

- A. 29.
- B. 42.
- C. 50.

38. Haley Hopkins plans to deposit \$24,000 into her retirement account at the end of every year for the next 15 years. The account will earn 12 percent every year. Assuming she does not make any withdrawals, how much money will she have at the end of 15 years after the last deposit?

- A. \$894,713.
- B. \$1,094,713.
- C. \$1,294,713.

39. You are computing the future value of an annuity. Assume that the annuity payment is \$120,000, the future value annuity factor is 21.664 and the interest rate is 4.50 percent per year. Which of the following are you *least likely* to use for computing the future value?

- A. Annuity amount.
- B. Future value annuity factor.
- C. Interest rate.

40. You have been making the following deposits on the last day of every month.

| Month    | Amount  |
|----------|---------|
| January  | \$1,500 |
| February | \$2,000 |
| March    | \$2,000 |
| April    | \$2,500 |
| May      | \$3,000 |
| June     | \$1,000 |

If the interest rate is 6 percent compounded monthly, how much money will you have on the 1<sup>st</sup> of July?

- A. \$12,000.
- B. \$12,148.
- C. \$13,903.

41. Liam Punter purchases a contract from an insurance company that promises to pay \$600,000 after 8 years with a 5 percent annual return. How much money should Punter *most likely* invest today?

- A. \$406,104.

- B. \$408,350.
- C. \$886,473.

42. Your client is evaluating between the following two retirement options:
- Option 1: Pays a lump sum of \$2.5 million today.
  - Option 2: A 25-year annuity at \$180,000 per year starting today.
- If your client's required rate of return is 6 percent per year, which option must he choose based on a higher present value?
- A. Option 1 as it has a greater present value.
  - B. Option 2 as it has a greater present value.
  - C. Either of the two options as they have an equal present value.

43. A security pays \$150 per year in perpetuity. What is its present value today, given that the required rate of return is 4.75 percent?
- A. \$316.
  - B. \$3158.
  - C. \$3185.

44. A security will make the following payments:

| Time Period | Dividend Amount (\$) |
|-------------|----------------------|
| 1           | 50                   |
| 2           | 100                  |
| 3           | 150                  |
| 4           | 200                  |
| 5           | 250                  |

Given a discount rate of 9 per cent, the present value of the security is *closest* to:

- A. \$487.
  - B. \$550.
  - C. \$616.
45. Wak O'Neal plans to buy a car worth \$42,000 today. He is required to pay 15 percent as a down payment and the remainder is to be paid as a monthly payment over the next 12 months with the first payment due at  $t = 1$ . Given that the interest rate is 8% per annum compounded monthly, which of the following is *most likely* to be the approximate monthly payment?
- A. \$3,105.
  - B. \$3,654.
  - C. \$3,921.
46. Hank plans to purchase a \$100,000 house by making a down payment of \$15,000. For the remainder, he intends to take a 20-year fixed rate mortgage with quarterly payments. The first payment is due at  $t = 1$ . The current mortgage interest rate is 10 per cent compounded quarterly. Which of the following is *most likely* to be Hank's quarterly mortgage payment?
- A. \$2,337.

- B. \$2,467.
- C. \$2,726.

47. An investor plans to buy a property worth \$200,000 for which he has agreed to 20 percent today as down payment. The remainder will be in the form of monthly payments over the next 15 years at 9 percent per year compounded monthly. Which of the following is *most likely* to be the monthly payment?
- A. \$1,137.
  - B. \$1,440.
  - C. \$1,623.

**LO.f: Demonstrate the use of a time line in modeling and solving time value of money problems.**

48. John Anderson wants to save for his daughter's college tuition. He will have to pay \$50,000 at the end of each year for the four years that her daughter attends college. He has 8 years until his daughter starts college to save up for her tuition. Using a 7% interest rate compounded annually, the amount Anderson would have to save each year for 8 years is *closest* to:
- A. \$22,000.
  - B. \$18,500.
  - C. \$16,500.
49. A 26 year old is using the following information to plan his retirement:

|  |          |
|--|----------|
| Current age  | 26       |
| Expected retirement age  | 65       |
| Life expectancy  | 90       |
| Current annual expenditures                                      | \$40,000 |
| Expected inflation rate of current expenditures until retirement | 2%       |
| Expected return on investment                                    | 7%       |

He assumes his consumption expenditure will increase at a rate of 2%, the rate of inflation, until he retires. Upon retiring, he will have end-of-year expenditures equal to his consumption expenditure at age 65. The minimum amount that he must accumulate by age 65 in order to fund his retirement is *closest* to:

- A. \$989,300.
  - B. \$1,009,080.
  - C. \$1,220,390.
50. Sandra Archer is planning for her retirement. She is 35 years old and expects to retire in the next 40 years. She expects to live for another 25 years after her retirement. Her current annual expenditures are \$54,000 and she expects them to increase at a rate of 3%, the rate of inflation, until she retires. Upon retiring, her end-of-year expenditures will be equal to her consumption expenditure at age 75. If the minimum amount that she can accumulate by age

- 75 is \$2 million, what is the *minimum* expected rate of return she must earn on her investment to maintain her consumption expenditure throughout her expected life after retirement?
- A. 7.29%.
  - B. 7.58%.
  - C. 7.87%.
51. Mr. Das Gupta is planning to save for his daughter's college tuition fund. His daughter is currently 11 years old and is expected to start college after 6 years. The expected annual fee for a four-year program is \$45,000. Assuming an expected rate of return on investment of 5%, the minimum amount that he must accumulate over the next 6 years in order to fund his daughter's college tuition fund is *closest* to:
- A. \$160,000.
  - B. \$170,000.
  - C. \$180,000.
52. Mathew Jones plans to pay for his son's college education for 4 years starting 8 years from today. He estimates the annual tuition cost at \$40,000 per year, when his son starts college. The tuition fees are payable at the beginning of each year. How much money must Jones invest every year, starting one year from today, for the next seven years? Assume the investment earns 10 percent annually.
- A. \$13,365.
  - B. \$11,087.
  - C. \$22,857.
53. Sally Smith is a pension fund manager. According to her estimates, retirees will be paid benefits worth \$0.75 million per year, starting 12 years from now. There will be a total of 20 payments. Given a discount rate of 8 percent, the present value of the payments today is *closest* to:
- A. \$2,924,191.
  - B. \$3,158,126.
  - C. \$7,363,610.
54. Bill Graham is planning to buy a security which pays a dividend of \$100 per year indefinitely, with the first payment to be received at  $t = 4$ . Given that the required rate of return is 10 percent per year compounded annually, how much should Graham pay today for the security?
- A. \$683.
  - B. \$751.
  - C. \$1,000.
55. Gerard Jones plans to save for his 5-year doctorate degree, which starts 6 years from now. The current annual expenditure is \$7,200 and it is expected to grow by 7 percent annually. Gerard will need to make the first payment 6 years from today. He identifies a savings plan

that allows him to earn an interest of 8 percent annually. How much should Gerard deposit each year, starting one year from today? Assume that he plans to make 5 payments.

- A. \$8,370.
- B. \$8,539.
- C. \$8,730.

SAMPLE

**Solutions**

1. A is correct. The required rate of return is the minimum rate of return an investor must receive to accept an investment.
2. C is correct. Interest rates can be interpreted as required rates of return, i.e. the minimum (not the maximum) rate of return an investor must receive in order to accept the investment.
3. A is correct. Nominal interest rate = real risk-free rate of return + inflation premium + risk premiums (default, liquidity, maturity premiums). Therefore, inflation premium = 15% - 3.5% - 3% - 4% - 2% = 2.5%.
4. A is correct. The difference in yield on otherwise identical U.S Treasury and corporate bonds is attributed to default risk.
5. B is correct. The maturity premium compensates investors for the increased sensitivity of the market value of debt to a change in market interest rates as maturity is extended. Option A describes liquidity risk. Option C describes credit risk.
6. A is correct. Liquidity premium can be best described as compensation to investors for the inability of selling a security at its fair market value.
7. C is correct. The nominal rate = real risk-free rate of return + an inflation premium + risk premiums (default, liquidity, maturity preference).  
In this case, 20 = 5 + 4 + X. Solve for X. X = 11.
8. C is correct. To calculate the required rate of return, we consider inflation premium, maturity premium, default risk premium, and liquidity premium. These are compensations for the different types of risk. There is nothing called nominal premium.
9. B is correct.

$$\text{Effective annual rate} = \left(1 + \frac{\text{stated annual interest}}{\text{number of periods}}\right)^{\text{number of periods}} - 1$$

$$\text{Effective annual rate} = \left(1 + \frac{0.22}{4}\right)^4 - 1$$

$$\text{Effective Annual Rate} \approx 24\%.$$

10. B is correct.

$$\text{Effective Annual Rate} = \left(1 + \frac{\text{Annual Interest Rate}}{m}\right)^m - 1$$

$$= (1 + 0.07/4)^4 - 1$$

$$= 7.18\%$$

An intuitive approach to this type of a question would be to find out the EAR using the quarterly compounding, and if the EAR in the question is smaller/bigger, the frequency of compounding would be less/more.

11. A is correct. Use the EAR (effective annual rate) to compare the investments:

| Investment | Formula                    | EAR           |
|------------|----------------------------|---------------|
| <b>CD1</b> | $(1 + .082/12)^{12} - 1$   | <b>8.515%</b> |
| CD2        | $(1 + .0825/4)^4 - 1$      | 8.509%        |
| CD3        | $e^{(0.080 \times 1)} - 1$ | 8.328%        |

12. C is correct. Solve for effective annual rate using:  $\left(1 + \frac{0.11}{365}\right)^{365} - 1 = 0.11625 \sim 11.63\%$ .

13. B is correct. The effective annual rate (EAR) is  $(1 + \text{Periodic interest rate})^n - 1$ . In this case, the periodic interest rate is  $0.18/12 = 0.015$  and the EAR is  $(1.015)^{12} - 1 = 0.1956 = 19.56\%$ .

14. C is correct. For discrete compounding, use the formula for calculating effective annual rate:

$$\text{EAR} = (1 + \text{Periodic Rate})^m - 1.$$

$$\text{EAR} = \left(1 + \frac{0.12}{4}\right)^4 - 1 = 0.1255 = 12.55\%.$$

15. A is correct. Use the formula for the effective annual rate with continuous compounding.

$$\text{EAR} = e^{\text{Continuously compounded rate}} - 1.$$

$$0.0745 = e^{\text{Continuously compounded rate}} - 1$$

$$1.0745 = e^{\text{Continuously compounded rate}}$$

$$\text{Continuously compounded rate} = \ln 1.0745 = 7.19\%.$$

16. C is correct. Rearranging the formula for future value, we can calculate the growth rate as:

$$\text{FV} = \text{PV}(1+r)^n$$

$$r = (\text{FV}/\text{PV})^{1/n} - 1$$

$$g = \left(\frac{5.229}{2.568}\right)^{\frac{1}{4}} - 1 = 19.5\%$$

Notice that  $N = 4$  because we assume that operating profits are at the end of the year. From the end of 2008 to the end of 2012, we have 4 years. Some students incorrectly use  $N = 5$ .

17. A is correct.

$$g = \left(\frac{81 - 14}{81}\right)^{\frac{1}{3}} - 1 = -6.1\%$$

The rate of growth in stores was around -6.1 percent during the period 2009-2012.

18. A is correct. The future value of an amount calculated using continuous compounding is:

$$\text{FV} = \text{PV} * e^{rt}$$

$$2238 = \text{PV} * e^{0.08 \times 5}$$

$$PV = \$1500.$$

19. A is correct. Using a financial calculator, compute PV:  
 $N=60$ ,  $\%i=9/12$ ,  $PMT=0$ ,  $FV=10,000$ . CPT PV.  $PV = 6,386.9$ .
20. C is correct. The future value of a given lump sum, calculated using continuous compounding, is  $FV = PV * e^{rt}$ . In this case,  $1000 \times e^{0.09 \times 6} = 1,716$ .
21. C is correct. Using a financial calculator, compute FV of \$2 million after 4 years:  
 $N = 4$ ,  $\%i = 7.5$ ,  $PV = -2,000,000$ ,  $PMT = 0$ , CPT FV.  $FV = 2.671$  million.
22. C is correct. Since the compounding is quarterly, the number of periods are  $2.5 * 4 = 10$ .  
 $N = 2.5 * 4 = 10$ ,  $\%i = 5/4 = 1.25$ ,  $PV = -5,000,000$ ,  $PMT = 0$ , CPT FV.  $FV = 5.661$ .
23. A is correct. Using a financial calculator, compute the future value of 12 million for a period of 8 years (or 11 years from now):  
 $N = 11 - 3 = 8$ ,  $\%i = 8\%$ ,  $PV = -12,000,000$ ,  $PMT = 0$ , CPT FV.  $FV = 22.21$  million.
24. C is correct. This is a future value problem that can be solved with these keystrokes:  
 $N = 3 * 4 = 12$ ,  $I / Y = 10 / 4 = 2.5$ ,  $PV = -80,000$ ,  $PMT = 0$ , CPT FV.  $FV = 107,591$ .
25. B is correct. The compounding frequency is daily, so there are 365 periods. Remember that this is still a discrete compounding problem.  
 $N = 365$ ,  $I / Y = 0.1095 (4 / 365)$ ,  $PV = -3,000,000$ ,  $PMT = 0$ , CPT FV.  $FV = 3.122$  million.
26. B is correct. This is a continuous compounding problem. To calculate the future value, use the formula  $FV = PVe^{rN}$ .  
 $FV = 50,000 e^{0.036 * 3} = 55,702$ .
27. C is correct. More frequent compounding results in a larger future value.
28. B is correct. Solve for N in the equation  $FV = PV (1+r)^N$ .  
 $I / Y = 6$ ,  $FV = 7500 (2500 * 3)$ ,  $PMT = 0$ ,  $PV = -2500$ , compute N.  
 $N = 18.9$   
 It will take 18.9 years approximately for an investment of \$2,500 to grow to \$7,500 at an interest rate of 6 percent.
29. A is correct.  
 $\%i = 0.583 (7 / 12)$ ,  $PV = 0$ ,  $PMT = -800$ ,  $FV = 100,000$ . Compute N.  
 $N = 94.17$   
 Note: it is important to use a -800 for PMT, not +800. If +800 is used the answer will be incorrect.

30. C is correct. Since the payment is made at the beginning of each quarter, this is an annuity due. Set the calculator to BGN mode for annuity due calculations.  
 $N = 4 \times 3 = 12$ ,  $I = 8/4 = 2\%$ ,  $PMT = 2500$ ,  $FV = 0$ , CPT PV.  $PV = \$26,967$ .
31. B is correct. The consumer's budget will support a monthly payment of \$1,500. Given a 25-year mortgage at 6.8 percent, the loan amount will be \$216,115.8. This is obtained by entering the following values:  
 $N = 300$ ,  $I = 6.8/12$ ,  $PMT = 1,500$ , CPT PV. If she makes a 10% down payment, then the most she can pay for the new house =  $\frac{\$216,116}{1 - 0.10} = \$240,129$ .
32. B is correct. The monthly interest rate is  $2.4/12 = 0.2$ . Using a financial calculator, compute PV.  $CF_0=0$ ,  $CF_1 = 360$ ,  $CF_2 = 550$ ,  $CF_3 = 400$ ,  $\%i = 0.2$  CPT NPV,  $PV = 1,304.70$ .
33. C is correct. Set the calculator to BGN mode for annuity due calculations and compute PV.  
 $N=12$ ,  $\%i=8/12 = 0.667$ ,  $PMT = 1200$ . Compute annuity due PV, CPT PV = 13,887.
34. C is correct. The monthly rate is:  $6\%/12 = 0.5\%$ . The number of monthly periods is  $30 \times 12 = 360$ . Using a financial calculator, compute PMT.  
 $N = 360$ ,  $\%i = 0.5$ ,  $PV = 200,000$ ,  $FV = 0$ . CPT PMT = 1,199.
35. A is correct. Using a financial calculator:  
 $N = 7 \times 12 = 84$ ,  $\%i = 12/12 = 1$ ,  $PV = 44,000$ ,  $FV = 0$ ; calculate PMT to be -776.72.
36. C is correct. Using a financial calculator:  
First, get into begin mode.  
 $N = 4 \times 12 = 48$ ,  $\%i = 3.5/12$ ,  $PMT = 500$ ,  $FV = 0$ , CPT PV = - 22,430.59
37. B is correct. First we need to calculate the present value of the expenditures. Using a financial calculator:  $N = 30$ ,  $\%i = 5$ ,  $PMT = 70,000$ ,  $FV = 0$ , CPT PV = - 1,076,071. Hence Roberts needs 1,076,071 to fund his retirement. Next we need to determine the number of years for which he must deposit 8,000 in order accumulate 1,076,071. Using a financial calculator:  $\%i = 5$ ,  $PV = 0$ ,  $PMT = 8,000$   $FV = - 1,076,071$ . CPT N = 41.9.
38. A is correct. This problem is to calculate the future value of an annuity. Using a financial calculator, compute FV.  
 $N = 15$ ,  $I / Y = 12$ ,  $PV = 0$ ,  $PMT = - 24,000$ , CPT FV.  $FV = 894,713$ .
39. C is correct because  $FV = PV * FV$  annuity factor. Therefore, the interest rate is least likely to be used for computation purposes.
40. B is correct. The stated annual rate is 6% with monthly compounding. The monthly rate is  $0.5\% = 0.005$ . Since the payment in January takes place on the last day of the month, there are 5 periods between 31<sup>st</sup> January and 1<sup>st</sup> July. The first payment compounds for 5 periods.

Similarly compute the future value for the remaining 5 payments with the last one happening on 30<sup>th</sup> June.

| Month      | Amount  | Periods | Future Value     |
|------------|---------|---------|------------------|
| Jan        | \$1,500 | 5       | 1,537.88         |
| Feb        | \$2,000 | 4       | 2,040.30         |
| Mar        | \$2,000 | 3       | 2,030.15         |
| Apr        | \$2,500 | 2       | 2,525.06         |
| May        | \$3,000 | 1       | 3,015.00         |
| Jun        | \$1,000 | 0       | 1,000.00         |
| <b>Sum</b> |         |         | <b>12,148.39</b> |

41. A is correct. We are required to calculate the present value of a lump sum here.  
 $N = 8, I / Y = 5, PMT = 0, FV = 600,000, CPT PV. PV = 406,104$   
 This implies that Liam must invest \$406,104 today in order to have 600,000 after 8 years, if the investment earns 5 percent annually.
42. A is correct. Compare the present value of the annuity with the lump sum to determine which has a higher present value. The present value of Option 1 is \$2.5 million. For option 2, use the formula for the present value of an annuity.  
 $N = 24$  (As 1 payment has been received),  $PMT = 180,000, \%i = 6, FV=0, CPT PV. PV = 2,259,064 + 180,000$  (Received today) = 2,439,064.  
 The lump sum option (option 1) is better as it has a higher present value.
43. B is correct. The formula for the present value of a perpetuity is:  

$$PV = \frac{A}{r}$$

$$PV = \frac{150}{0.0475} = \$3158$$
44. B is correct. Enter the following cash flows into the calculator, use an interest rate of 9% and compute the NPV.

| Keystrokes           | Explanation             | Display   |
|----------------------|-------------------------|-----------|
| [2nd] [QUIT]         | Return to standard mode | 0         |
| [CF] [2nd] [CLR WRK] | Clear CF Register       | CF = 0    |
| 0 [ENTER]            | No cash flow at T = 0   | CF0 = 0   |
| [↓] 50 [ENTER]       | Enter CF at T = 1       | C01 = 50  |
| [↓] [↓] 100 [ENTER]  | Enter CF at T = 2       | C02 = 100 |
| [↓] [↓] 150 [ENTER]  | Enter CF at T = 3       | C03 = 150 |

|                       |                     |           |
|-----------------------|---------------------|-----------|
| [↓] [↓] 200 [ENTER]   | Enter CF at T = 4   | C04 = 200 |
| [↓] [↓] 250 [ENTER]   | Enter CF at T = 5   | C03 = 250 |
| [↓] [NPV] [9] [ENTER] | Enter discount rate | I = 9     |
| [↓] [CPT]             | Compute NPV         | 550.03    |

45. A is correct. Remainder after down payment for which mortgage should be taken:  
 $42,000 * 0.85 = 35,700$   
 $N = 12, I / Y = 8/12 = 0.666, PV = - 35,700, FV = 0, CPT PMT$   
 $PMT = 3,105.$
46. B is correct. Remainder funded through mortgage=  $\$100,000 - \$15,000 = \$85,000$   
The present value of all the quarterly mortgage payments for 20 years must be equal to the amount borrowed. We are required to solve for the annuity amount. The keystrokes are as follows:  
 $N = 80 (20 * 4)$  (4 payments, one each quarter, for 20 years),  $I / Y = 10/4 = 2.5, PV = - 85,000, FV = 0, CPT PMT$   
 $PMT = 2,467.$
47. C is correct. Downpayment =  $\$200,000 * 0.20 = \$40,000$   
Remainder funded through mortgage =  $\$200,000 - \$40,000 = \$160,000$   
Present value of the payments must be equal to the amount borrowed. We are required to solve for the annuity amount. The keystrokes are as follows:  
 $N = 180 (15 * 12)$  (12 payments in a year for 15 years),  $I / Y = 9/12 = 0.75\%, PV = -160,000, FV = 0, CPT PMT.$   
 $PMT = 1,623$   
This implies that  $\$160,000$  is equal to 180 equal monthly payments of 1,623 at an interest rate of 9 per cent. Remember that calculating the mortgage payment is equivalent to determining a level annuity payment.
48. C is correct. A payment of 50,000 has to be made at the end of every year for 4 years of college. The present value of these four payments at the start of college (one year before the first payment) can be calculated as follows:  $N = 4; \%i = 7, PMT = 50,000, FV = 0. CPT PV = -169,360.$  Next we need to compute how much Anderson must deposit every year in order to accumulate 169,360 at the end of 8 years. This can be calculated as follows:  $N = 8, \%i = 7, PV = 0, FV = 169,360. CPT PMT = 16,507.$  Option C is the closest answer.
49. B is correct. First we need to calculate the expenditure at age 65 given 2% inflation. Since he is currently 26 we need to compound over 39 years ( $65 - 26 = 39$ ). Using a calculator:  $N = 39, \%i = 2, PV = 40,000, PMT = 0. CPT FV = 86,590.$  This expenditure is expected to continue till age 90. From age 65 to age 90 is 25 years. In other words to fund his retirement he needs a 25 year,  $\$86,590$  annuity. The present value of this annuity at age 65 can be calculated as follows:  $N = 25, \%i = 7, PMT = 86,590, FV = 0, CPT PV = 1,009,084.$

50. A is correct. Her consumption spending (currently \$54,000 annually) increases at the rate of inflation (3%) over the next 40 years until she retires. Her annual consumption spending at the time she retires will be \$176,150.04:  $N = 40$ ,  $\%i = 3$ ,  $PV = 54,000$ , CPT FV. To support that level of spending for 25 years of retirement, assuming she has accumulated \$2 million by her retirement age, she must earn a 7.29% return on her retirement account:  
 $N = 25$ ,  $PMT = 176,150.04$ ,  $PV = -2,000,000$ , CPT  $\%i$ .

51. A is correct. To fund the tuition fees assuming a 5% return on his daughter's fund, he must accumulate \$159,568  $\approx$  160,000 by the time his daughter starts college:  
 $N=4$ ,  $\%i = 5$ ,  $PMT = 45,000$ , CPT PV.

52. B is correct. First draw a timeline:



There are two steps to this problem:

1. First, calculate the present value of the four \$40,000 payments at  $t = 7$ . The four college payments represent an annuity. So, this is equivalent to calculating the present value of an annuity.

$N = 4$ ,  $\%i = 10$ ,  $PMT = 40000$ ,  $FV = 0$ , CPT PV.  
 PV at the end of year 7 = 126,794.62.

2. Next, calculate the value of the payment to be made every year from year 1 to year 7. To do this, equate the value at end of year 7 calculated in the previous step to the future value of 7 investments of X at year 7. This uses the formula for the future value of an annuity.

$N = 7$ ,  $\%i = 10$ ,  $PV = 0$ ,  $FV = 126,794.62$ , CPT PMT.  
 PMT = 13,364.85.

Jones must invest 13,364.85 each year for 7 years, starting next year, towards his son's tuition fees.

53. B is correct. Given that the first annuity payment will be at the end of Year 12, we should compute the present value at the end of Year 11.  
 $N = 20$ ,  $\%i = 8$ ,  $PMT = 750,000$ ,  $FV = 0$ , CPT PV.  
 The present value of 20 \$0.75 million payments at the end of Year 11 is 7,363,610.56.  
 Next, discount it back to  $t = 0$  to determine its present value today:

$$PV_{\text{today}} = \frac{7,363,610}{(1+0.08)^{11}} = \$3,158,126.$$

54. B is correct. We are required to calculate the present value of a perpetuity at  $t=3$  and then discount it back to  $t=0$ .

$$PV_{t=3} = \frac{100}{0.1} = \$1,000$$

$$PV_{\text{today}} = \frac{1,000}{(1 + 0.10)^3} = \$751$$

Graham must pay \$751 to receive \$100 per year indefinitely after four years.

55. A is correct. This problem can be solved in two steps.

Step 1: Find the annual expenditures

$$\text{Annual Expenditure}_{t=6} = 7,200 (1 + 0.07)^6 = \$10,805$$

$$\text{Annual Expenditure}_{t=7} = 7,200 (1 + 0.07)^7 = \$11,562$$

$$\text{Annual Expenditure}_{t=8} = 7,200 (1 + 0.07)^8 = \$12,371$$

$$\text{Annual Expenditure}_{t=9} = 7,200 (1 + 0.07)^9 = \$13,237$$

$$\text{Annual Expenditure}_{t=10} = 7,200 (1 + 0.07)^{10} = \$14,163$$

Step 2: Find the present value of annual expenditures at  $t = 5$

| Time Period | Annual Expenditure (\$) | Present Value                  |
|-------------|-------------------------|--------------------------------|
| 6           | 10,805                  | $10,805 (1.08)^{-1} = 10,004$  |
| 7           | 11,562                  | $11,562 (1.08)^{-2} = 9,912.5$ |
| 8           | 12,371                  | $12,371 (1.08)^{-3} = 9,820.5$ |
| 9           | 13,237                  | $13,237 (1.08)^{-4} = 9,729.6$ |
| 10          | 14,163                  | $14,163 (1.08)^{-5} = 9,639$   |
|             |                         | SUM = \$49,106                 |

Step 3: Find the annuity payment

$$N = 5, \%i = 8, PV = 0, FV = 49,106, \text{CPT PMT.}$$

$$\text{PMT} = 8,370.$$