

Appendix E

Accounting and the Time Value of Money

Learning Objectives – Coverage by question					
	True / False	Multiple Choice	Exercises	Essay / Short Answer	Problems
LO1 —Describe the nature of interest and distinguish between simple and compound interest.	1, 2	1		1	
LO2 —Calculate future values.	3	2, 4	3, 4, 6		2
LO3 —Calculate present values.	3	3	1, 2, 5		1

Appendix E: Accounting and the Time Value of Money

True/False

Topic: Compound Interest

LO: 1

1. When interest is earned on interest in a savings account in a bank, this is called compound interest.

Answer: True

Topic: Time Value of Money

LO: 1

2. A dollar received today is worth more than a dollar received two years ago.

Answer: False

Rationale: A dollar received two years ago is worth more than a dollar received today as it can be invested and will earn additional interest.

Topic: Compounding

LO: 2, 3

3. If an investment is made that pays 8% annual interest for a 5-year period with quarterly compounding, the number of periods is 60.

Answer: False

Rationale: There are 20 quarterly periods in five years: 5 years $\times$ 4 times per year = 20 periods of compounding.

Multiple Choice

Topic: Time Value of Money

LO: 1

Level of Difficulty: EASY

1. Why is one dollar now worth more than one dollar in the future?
 - A) The amount to be received in the future is smaller than the amount to be paid off today
 - B) The value of interest declines over time
 - C) Funds can be invested in earning assets to yield a positive return
 - D) The time value of money depreciates over long periods of time

Answer: C

Rationale: Investing money received today generates interest so that the investor will have more accumulated funds compared to waiting to receive funds in the future.

Topic: Future Value

LO: 2

Level of Difficulty: MEDIUM

2. If Mr. Chips, Inc. invests \$2,400,000 today at 6% annual interest and the money is compounded semiannually, how much will be in the bank account one year from the date invested?
 - A) \$2,472,000
 - B) \$2,544,000
 - C) \$2,546,160
 - D) \$2,547,273

Answer: C

Rationale:

Amount at end of 6 months: $\$2,400,000 + (\$2,400,000 \times 6\% \times 6/12) = \$2,472,000$

Amount at end of 12 months: $\$2,472,000 + (\$2,472,000 \times 6\% \times 6/12) = \$2,546,160$

Topic: Present Value of an Investment

LO: 3

Level of Difficulty: MEDIUM

3. Mr. Chips, Inc. wishes to accumulate \$1,200,000 to be used to pay off a balloon note at the end of 5 years.

How much will Mr. Chips need to invest today to accumulate the desired amount if the investment earns an annual rate of 8% compounded quarterly? (Select the closest amount.)

- A) \$257,458
- B) \$1,783,167
- C) \$807,564
- D) \$1,086,877

Answer: C

Rationale:

Present value of \$1,200,000 at $n = 5 \times 4 = 20$, $i = 8\%/4 = 2\%$

$PV = \$1,200,000 \times 0.67297 = \$807,564$

Financial calculator:

$N = (5 \times 4) = 20$ $I/Y = (8 / 4) = 2$ $PV = ?$ $PMT = 0$ $FV = 1,200,000$
 $PV = \$807,565.60$ (rounded)

Topic: Future Value of an Annuity

LO: 2

Level of Difficulty: MEDIUM

4. Mr. Chips, Inc. wishes to accumulate \$2,000,000 to be used to pay off a loan at the end of 10 years.

How much will Mr. Chips deposit each year for 10 years (rounded to the nearest dollar), beginning at the end of the first year, to accumulate the desired amount if the investment earns an annual rate of 6%?

- A) \$151,736
- B) \$143,147
- C) \$259,215
- D) \$200,000

Answer: A

Rationale:

Future value of an annuity factor at $n = 10$, $i = 6\%$

$PMT = \$2,000,000 / 13.18079 = \$151,736$ (rounded)

Financial calculator:

$N = 10$ $I/Y = 6$

$PMT = ?$

$PV = 0$

$FV = 2,000,000$

$PMT = 151,736$

Exercises

Topic: Present Value of a Sum

LO: 3

1. Electric Motor Company wants to accumulate \$20,000,000 to pay off an equipment loan due in 5 years.

How much should Electric Motor Company deposit today if the bank pays 6% interest compounded annually?

Answer:

Present value of a single amount of \$20,000,000 at $n = 5$; $i = 6\%$

$$\$20,000,000 \times 0.74726 = \$14,945,200$$

Financial calculator:

$$\begin{array}{lllll} N = 5 & I/Y = 6 & PV = ? & PMT = 0 & FV = 20,000,000 \\ PV = \$14,945,163 \text{ (rounded)} \end{array}$$

Topic: Present Value of a Sum

LO: 3

2. Electric Motor Company wants to accumulate \$20,000,000 to pay off an equipment loan due in 5 years.

How much should Electric Motor Company deposit today if the bank pays 6% interest compounded semi-annually?

Answer:

Present value of a single amount of \$20,000,000 at $n = 5 \times 2 = 10$; $i = 6\%/2 = 3\%$

$$\$20,000,000 \times 0.74409 = \$14,881,800$$

Financial calculator:

$$\begin{array}{lllll} N = (5 \times 2) = 10 & I/Y = (6 / 2) = 3 & PV = ? & PMT = 0 & FV = 20,000,000 \\ PV = \$14,881,878 \text{ (rounded)} \end{array}$$

Topic: Future Value of an Annuity

LO: 2

3. Electric Motor Company wants to accumulate \$16,000,000 to pay off an equipment balloon note due in 3 years.

How much should Electric Motor Company deposit each quarter beginning one quarter from today to accumulate the amount required if the bank pays 4% annual interest compounded quarterly?

Answer:

Future value of an annuity of ? at $n = 3 \times 4 = 12$; $i = 4\%/4 = 1\%$ = \$16,000,000

$$\$16,000,000 / 12.68250 = \$1,261,581 \text{ (rounded)}$$

Financial calculator:

$$\begin{array}{lllll} N = 12 & I/Y = 1 & PV = 0 & PMT = ? & FV = 16,000,000 \\ PMT = \$1,261,581 \text{ (rounded)} \end{array}$$

Topic: Future Value of a Sum**LO: 2**

4. Solar Co. needs to have \$200 million accumulated to fund health insurance payments for its retirees.

Will Solar Co. have enough accumulated at the end of 3 years if it deposits \$165 million today if compounding occurs semi-annually with an annual rate of 6%?

Answer:

Future value of a sum of \$165,000,000 at $n = 3 \times 2 = 6$; $I = 6\%/2 = 3\%$

$\$165,000,000 \times 1.19405 = \$197,018,250$

Financial calculator:

$N = (3 \times 2) = 6$ $I/Y = (6/2) = 3$ $PV = 165,000,000$ $PMT = 0$ $FV = ?$
 $FV = \$197,018,629$ (rounded)

No. It will have \$197.019 million accumulated, which is not enough to fund the health insurance.

Topic: Installment Note**LO: 3**

5. Solar Co. borrowed \$5,000,000 to buy equipment to be repaid as an installment note monthly over 2.5 years.

How much will Solar Co. pay each month if payments begin one month from now and the loan rate is 12% compounded monthly?

Answer:

Present value of an annuity of ? at $n = 2.5 \times 12 = 30$; $I = 12\%/12 = 1\%$

$\$5,000,000 / 25.80771 = \$193,741$ (rounded)

Financial calculator:

$N = (2.5 \times 12) = 30$ $I/Y = (12 / 12) = 1$ $PV = 5,000,000$ $FV = 0$ $PMT = ?$
 $PMT = \$193,741$ (rounded)

Topic: Future Value of a Sum**LO: 2**

6. Solar Co. borrowed \$300,000,000 to buy equipment with the principal and interest to be repaid as a balloon note at the end of 5 years.

How much will Solar Co. pay to liquidate the principal of the note at the maturity date if interest is 8% compounded quarterly?

Answer:

Future value of a sum of \$300,000,000 at $n = 5 \times 4 = 20$; $I = 8\%/4 = 2\%$

$\$300,000,000 \times 1.48595 = \$445,785,000$

Financial calculator:

$N = 20$ $I/Y = 2$ $PV = 300,000,000$ $FV = ?$ $PMT = 0$
 $FV = \$445,784,219$ (rounded)

Essay and Short Answer

Topic: Time Value of Money

LO: 1

1. Why is one dollar now worth more than one dollar in the future?

Answer:

One reason that a dollar now is worth more than a dollar in the future is risk. Because the future is always uncertain, some event may prevent you from receiving the dollar at a later date. To avoid this risk, we choose the earlier date.

A second reason a dollar is worth more now than one dollar in the future is that the dollar has a time value—that is, the dollar received now could be invested such that one year from now, you could have not only the original dollar but also the interest income on the dollar for the past year.

Problems

Topic: Present Value Calculations

LO: 3

1. An investment of \$1,600,000 will return \$320,000 per year for 6 years. Should the investment be undertaken if the discount rate is 5% and interest is compounded once per year?

Answer:

Present value of an annuity: \$320,000 at $n = 6$; $i = 5\%$
 $\$320,000 \times 5.07569 = \$1,624,221$ (rounded)

Financial calculator:

$N = 6$ $i/Y = 5$ $PV = ?$ $PMT = 320,000$
 $PV = \$1,624,221$ (rounded)

Yes. Based on the financial aspects of the investment, it should be undertaken as the present value of \$1,624,221 is greater than the initial investment.

Topic: Future Value Calculations

LO: 2

2. Compute the future value for each of the following amounts.
 - a. \$200,000 invested today for 8 years if annual interest rate is: (1) 10% compounded annually or (2) 10% compounded semiannually
 - b. \$20,000 received at the end of each year for the next 4 years if the money is worth 8% per year compounded annually

Answer:

- a. Future value of a sum of \$200,000 at $n = 8$; $i = 10\%$
(1) $\$200,000 \times 2.14359 = \$428,718$

Financial calculator:

$N = 8$ $i/Y = 10$ $PV = 200,000$ $PMT = 0$ $FV = ?$
 $FV = \$428,718$ (rounded)

Future value of a sum of \$200,000 at $n = 8 \times 2 = 16$; $i = 10\%/2 = 5\%$
(2) $\$200,000 \times 2.18287 = \$436,574$

Financial calculator:

$N = 16$ $i/Y = 5$ $PV = 200,000$ $PMT = 0$ $FV = ?$
 $FV = \$436,575$ (rounded)

- b. Future value of an annuity of \$20,000 at $n = 4$; $i = 8\%$
 $\$20,000 \times 4.50611 = \$90,122$ (rounded)

Financial calculator:

$N = 4$ $i/Y = 8$ $PV = 0$ $PMT = 20,000$ $FV = ?$
 $FV = \$90,122$ (rounded)