

# CHAPTER 6

## Accounting and the Time Value of Money

### ASSIGNMENT CLASSIFICATION TABLE

Topics	Questions	Brief		
		Exercises	Exercises	Problems
1. Present value concepts. Expected cash flows.	1, 2, 3, 4, 5, 9, 17		2, 3	6, 7
2. Use of tables.	13, 14	8	1	
3. Present and future value problems:				
a. Unknown future amount.	7, 19	1, 5, 13	2, 3, 4, 6, 8, 9, 13	
b. Unknown payments.	10, 11, 12	6, 12, 17	9, 18, 19	2, 8
c. Unknown number of periods.		4, 9	10, 17	2
d. Unknown interest rate.	15, 18	3, 11, 16	9, 11, 16	2, 9
e. Unknown present value.	8, 19	2, 7, 8, 10, 14	2, 3, 4, 5, 6, 7, 8, 10, 14, 19, 20, 21	1, 4, 6, 7, 9
4. Value of a series of irregular deposits; changing interest rates.				3, 5, 10
5. Valuation of leases, pensions, bonds; choice between projects.	6	15	12, 13, 14, 15, 16	3, 5, 7, 8, 10, 11, 12, 13, 14
6. Deferred annuity.	16			9
*7. Uses of a calculator.			22, 23, 24	15, 16, 17

## ASSIGNMENT CHARACTERISTICS TABLE

Item	Description	Level of Difficulty	Time (minutes)
E6-1	Using interest tables.	Simple	5-10
E6-2	Expected Cash Flows.	Simple	5-10
E6-3	Expected Cash Flows.	Moderate	15-20
E6-4	Simple and compound interest.	Simple	5-10
E6-5	Computation of future values and present values.	Simple	10-15
E6-6	Annuity due problems.	Moderate	15-20
E6-7	Ordinary annuity problems.	Simple	10-15
E6-8	Future value and present value problems.	Moderate	15-20
E6-9	Computation of bond prices.	Moderate	12-17
E6-10	Computations for a retirement fund.	Simple	10-15
E6-11	Unknown interest rate.	Moderate	5-10
E6-12	Unknown periods and unknown interest rate.	Simple	10-15
E6-13	Evaluation of financing options.	Moderate	10-15
E6-14	Analysis of alternatives.	Simple	10-15
E6-15	Computation of present value of bonds.	Moderate	15-20
E6-16	Computation of pension liability.	Moderate	15-20
E6-17	Unknown Periods, deferred annuity.	Moderate	15-20
E6-18	Retirement of debt.	Simple	10-15
E6-19	Computation of amount of rentals.	Simple	10-15
E6-20	Least costly payoff—ordinary annuity.	Simple	10-15
E6-21	Least costly payoff—annuity due.	Simple	10-15
*E6-22	Determining the interest rate with a calculator.	Simple	3-5
*E6-23	Determining the interest rate with a calculator.	Simple	3-5
*E6-24	Determining the interest rate with a calculator.	Simple	3-5
P6-1	Computation of present value.	Moderate	15-20
P6-2	Computation of unknown interest factors.	Moderate	15-20
P6-3	Analysis of alternatives.	Moderate	20-30
P6-4	Evaluating payment alternatives.	Moderate	20-30
P6-5	Analysis of alternatives.	Moderate	20-25
P6-6	Expected cash flows and present value.	Moderate	20-25
P6-7	Expected cash flows and present value.	Moderate	20-25
P6-8	Purchase price of a business (deferred annuities).	Moderate	25-30
P6-9	Time value concepts applied to solve business problems.	Complex	30-35
P6-10	Analysis of alternatives.	Moderate	20-30
P6-11	Analysis of business problems.	Complex	30-35
P6-12	Analysis of lease versus purchase.	Complex	25-30

## Assignment Characteristics Table (Continued)

P6-13	Retirement funding, deferred annuity.	Complex	25-30
P6-14	Pension funding—Ethics	Moderate	20-25
*P6-15	Solving unknowns with a calculator.	Moderate	10-15
*P6-16	Solving unknowns with a calculator.	Moderate	10-15
*P6-17	Solving unknowns with a calculator.	Moderate	10-15

# ANSWERS TO QUESTIONS

1. Money has value because with it one can acquire assets and services and discharge obligations. The holding, borrowing or lending of money can result in costs or earnings. And the longer the time period involved, the greater the costs or the earnings. The cost or earning of money as a function of time is the time value of money.

Accountants must have a working knowledge of compound interest, annuities, and present value concepts because of their application to numerous types of business events and transactions which require proper valuation and presentation. These concepts are applied in the following areas: (1) sinking funds, (2) installment contracts, (3) pensions, (4) long-term assets, (5) leases, (6) notes receivable and payable, (7) business combinations, and (8) amortization of premiums and discounts.

2. Some situations in which present value measures are used in accounting include:
  - (a) Notes receivable and payable—these involve single sums (the face amounts) and may involve annuities, if there are periodic interest payments.
  - (b) Leases—involve measurement of assets and obligations, which are based on the present value of annuities (lease payments) and single sums (if there are residual values to be paid at the conclusion of the lease).
  - (c) Pensions and other deferred compensation arrangements—involve discounted future annuity payments that are estimated to be paid to employees upon retirement.
  - (d) Bond Pricing—the price of bond payable is comprised of the present value of the principal or face value of the bond plus the present value of the annuity of interest payments.
  - (e) Long-term assets—evaluating various long-term investments or assessing whether an asset is impaired requires determining the present value of the estimated cash flows (may be single sums and/or an annuity).
3. Interest is the payment for the use of money. It may represent a cost or earnings depending upon whether the money is being borrowed or loaned. The earning or incurring of interest is a function of the time, the amount of money, and the risk involved (reflected in the interest rate).

Simple interest is computed on the amount of the principal only, while compound interest is computed on the amount of the principal plus any accumulated interest. Compound interest involves interest on interest while simple interest does not.

4. The interest rate generally has three components:
  - (1) Pure rate of interest—This would be the amount a lender would charge if there were no possibilities of default and no expectation of inflation.
  - (2) Credit risk rate of interest—The government has little or no credit risk (i.e., risk of nonpayment) when it issues bonds. A business enterprise, however, depending upon its financial stability, profitability, etc. can have a low or a high credit risk.
  - (3) Expected inflation rate of interest—Lenders recognize that in an inflationary economy, they are being paid back with less valuable dollars. As a result, they increase their interest rate to compensate for this loss in purchasing power. When inflationary expectations are high, interest rates are high.

Accountants must have knowledge about these components because these components are essential in identifying an appropriate interest rate for a given company or investor at any given moment.

5.
  - (a) Present value of an ordinary annuity at 8% for 10 periods (Table 6-4).
  - (b) Future value of 1 at 8% for 10 periods (Table 6-1).
  - (c) Present value of 1 at 8% for 10 periods (Table 6-2).
  - (d) Future value of an ordinary annuity at 8% for 10 periods (Table 6-3).

## Questions Chapter 6 (Continued)

6. He should choose quarterly compounding, because the balance in the account on which interest will be earned will be increased more frequently, thereby resulting in more interest earned on the investment. As shown in the following calculation:

Semi-annual compounding, assuming the amount is invested for 2 years:

$$\begin{aligned} n &= 4 \\ \$1,000 \times 1.16986 &= \$1,169.86 \\ i &= 4 \end{aligned}$$

Quarterly compounding, assuming the amount is invested for 2 years:

$$\begin{aligned} n &= 8 \\ \$1,000 \times 1.17166 &= \$1,171.66 \\ i &= 2 \end{aligned}$$

Thus, with quarterly compounding, Bill could earn \$1.80 more.

7.  $\$24,208.02 = \$18,000 \times 1.34489$  (future value of 1 at  $2\frac{1}{2}\%$  for 12 periods).
8.  $\$27,919.50 = \$50,000 \times .55839$  (present value of 1 at 6% for 10 periods).
9. An annuity involves (1) periodic payments or receipts, called rents, (2) of the same amount, (3) spread over equal intervals, (4) with interest compounded once each interval.

Rents occur at the end of the intervals for ordinary annuities while the rents occur at the beginning of the intervals for annuities due.

10. Amount paid each year =  $\frac{\$30,000}{3.03735}$  (present value of an ordinary annuity at 12% for 4 years).

Amount paid each year = \$9,877.03.

11. Amount deposited each year =  $\frac{\$160,000}{4.64100}$  (future value of an ordinary annuity at 10% for 4 years).

Amount deposited each year = \$34,475.33.

12. Amount deposited each year =  $\frac{\$160,000}{5.10510}$  [future value of an annuity due at 10% for 4 years (4.64100 X 1.10)].

Amount deposited each year = \$31,341.21.

13. The process for computing the future value of an annuity due using the future value of an ordinary annuity interest table is to multiply the corresponding future value of the ordinary annuity by one plus the interest rate. For example, the factor for the future value of an annuity due for 4 years at 12% is equal to the factor for the future value of an ordinary annuity times 1.12.
14. The basis for converting the present value of an ordinary annuity table to the present value of an annuity due table involves multiplying the present value of an ordinary annuity factor by one plus the interest rate.

15. Present value = present value of an ordinary annuity of \$25,000 for 20 periods at ? percent.

\$210,000 = present value of an ordinary annuity of \$25,000 for 20 periods at ? percent.

Present value of an ordinary annuity for 20 periods at ? percent =  $\frac{\$210,000}{\$25,000} = 8.4$ .

The factor 8.4 is closest to 8.51356 in the 10% column (Table 6-4).

16. 4.96764 Present value of ordinary annuity at 12% for eight periods.

2.40183 Present value of ordinary annuity at 12% for three periods.

2.56581 Present value of ordinary annuity at 12% for eight periods, deferred three periods.

The present value of the five rents is computed as follows:

$$2.56581 \times \$10,000 = \underline{\$25,658.10}.$$

17. (a) Present value of an annuity due.

(b) Present value of 1.

(c) Future value of an annuity due.

(d) Future value of 1.

18. \$27,000 = PV of an ordinary annuity of \$6,900 for five periods at ? percent.

$$\frac{\$27,000}{\$6,900} = \text{PV of an ordinary annuity for five periods at ? percent.}$$

3.91 = PV of an ordinary annuity for five periods at ?.

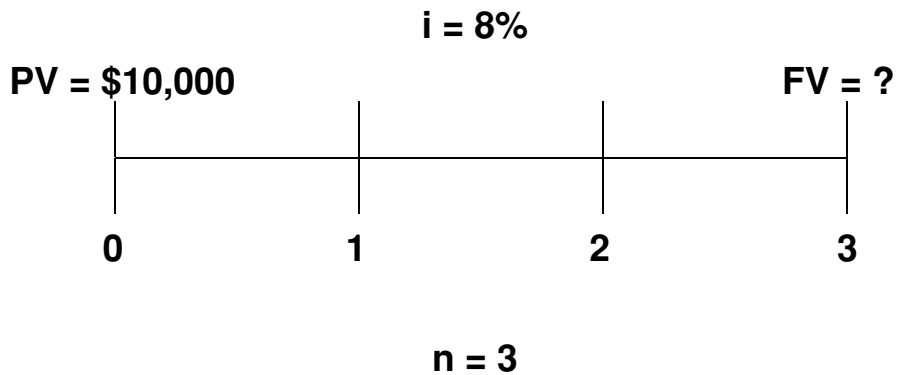
3.91 = approximately 9%.

19. The IRS argues that the future reserves should be discounted to present value. The result would be smaller reserves and therefore less of a charge to income. As a result, income would be higher and income taxes would therefore be higher as well.

# SOLUTIONS TO BRIEF EXERCISES

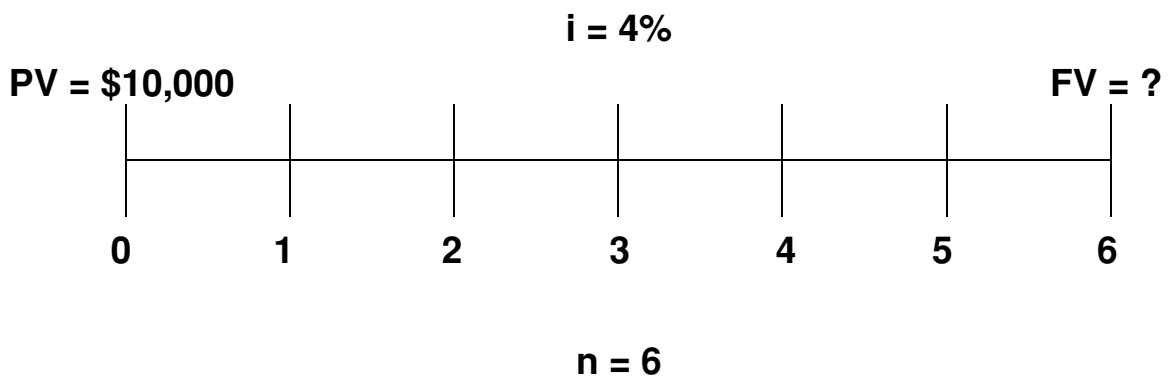
## BRIEF EXERCISE 6-1

8% annual interest



$$\begin{aligned} \text{FV} &= \$10,000 (\text{FVF}_{3, 8\%}) \\ \text{FV} &= \$10,000 (1.25971) \\ \text{FV} &= \$12,597.10 \end{aligned}$$

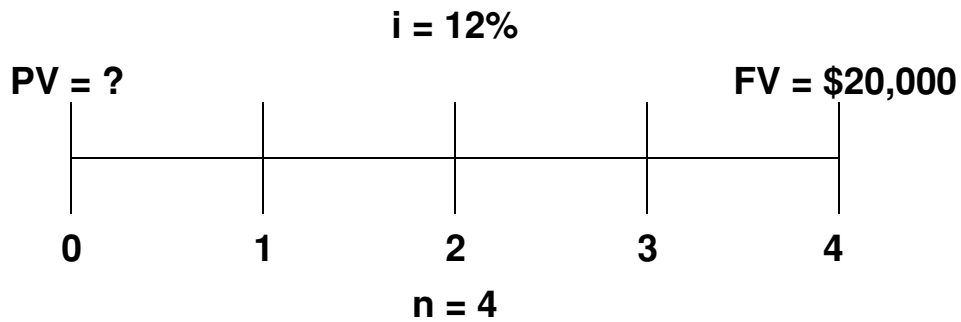
8% annual interest, compounded semiannually



$$\begin{aligned} \text{FV} &= \$10,000 (\text{FVF}_{6, 4\%}) \\ \text{FV} &= \$10,000 (1.26532) \\ \text{FV} &= \$12,653.20 \end{aligned}$$

## BRIEF EXERCISE 6-2

### 12% annual interest

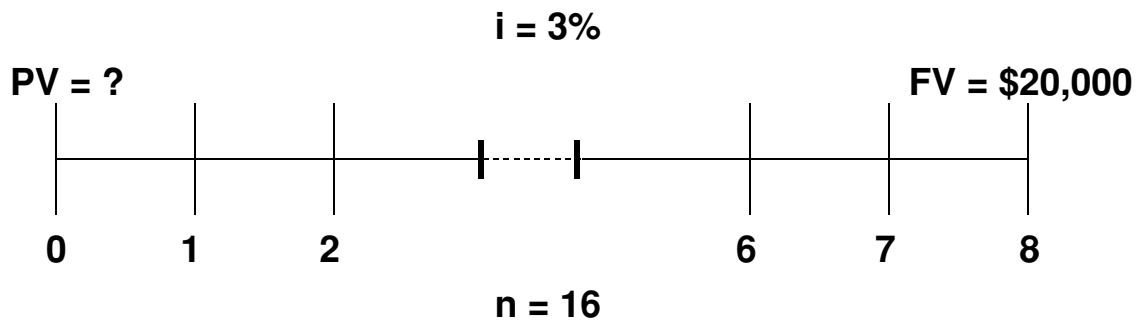


$$PV = \$20,000 (PVF_{4, 12\%})$$

$$PV = \$20,000 (.63552)$$

$$PV = \$12,710.40$$

### 12% annual interest, compounded quarterly



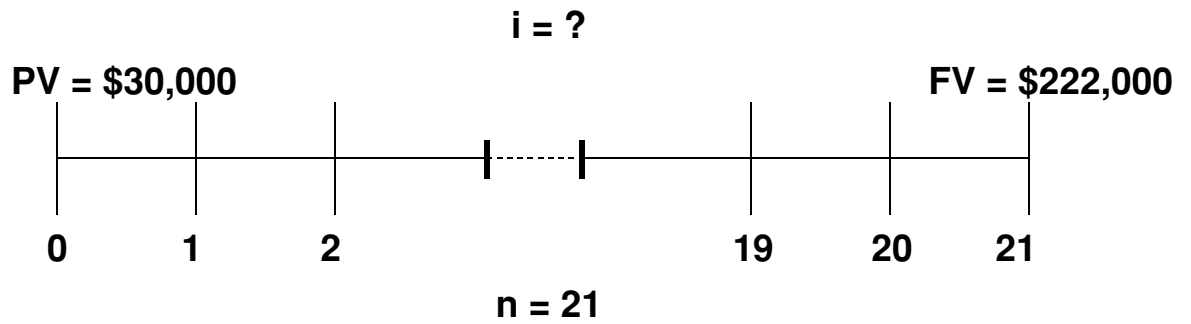
$$PV = \$20,000 (PVF_{16, 3\%})$$

$$PV = \$20,000 (.62317)$$

$$PV = \$12,463.40$$



### BRIEF EXERCISE 6-3



$$FV = PV (FVF_{21, i})$$

$$\$222,000 = \$30,000 (FVF_{21, i})$$

$$FVF_{21, i} = 7.40000$$

$$i = 10\%$$

$$PV = FV (PVF_{21, i})$$

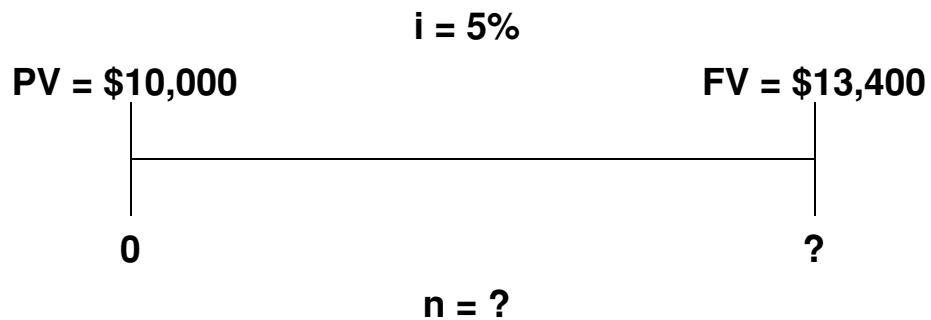
$$\$30,000 = \$222,000 (PVF_{21, i})$$

$$PVF_{21, i} = .13514$$

$$i = 10\%$$

OR

### BRIEF EXERCISE 6-4



$$FV = PV (FVF_{n, 5\%})$$

$$\$13,400 = \$10,000 (FVF_{n, 5\%})$$

$$FVF_{n, 5\%} = 1.34000$$

$$n = 6 \text{ years}$$

$$PV = FV (PVF_{n, 5\%})$$

$$\$10,000 = \$13,400 (PVF_{n, 5\%})$$

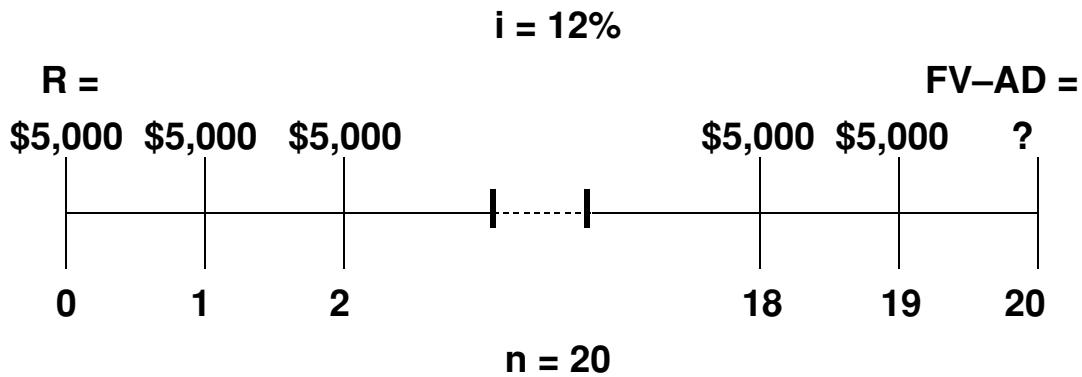
$$PVF_{n, 5\%} = .74627$$

$$n = 6 \text{ years}$$

OR

## BRIEF EXERCISE 6-5

### First payment today

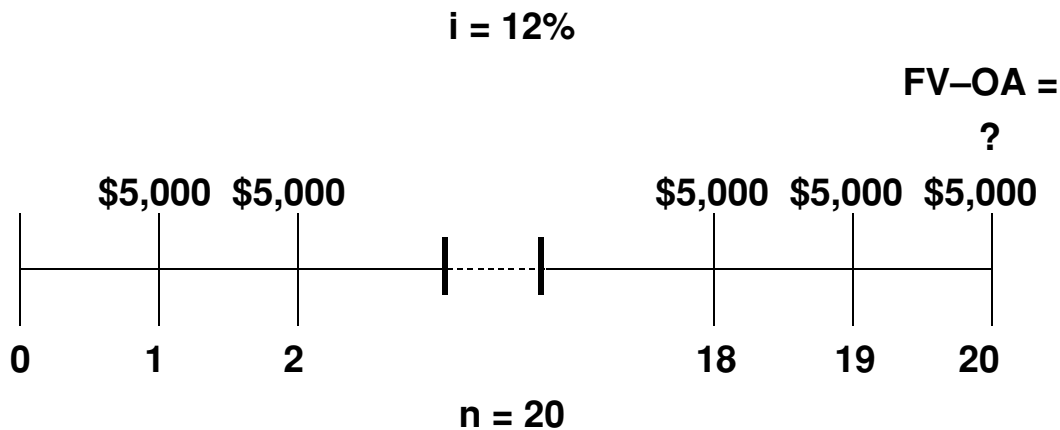


$$FV-AD = \$5,000 (FVF-OA_{20, 12\%}) 1.12$$

$$FV-AD = \$5,000 (72.05244) 1.12$$

$$FV-AD = \$403,494$$

### First payment at year-end

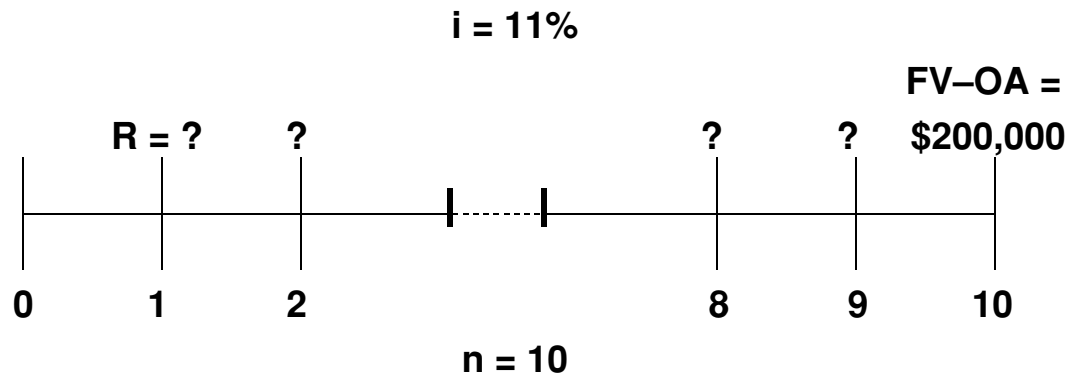


$$FV-OA = \$5,000 (FVF-OA_{20, 12\%})$$

$$FV-OA = \$5,000 (72.05244)$$

$$FV-OA = \$360,262$$

## BRIEF EXERCISE 6-6



$$\$200,000 = R (FVF-OA_{10, 11\%})$$

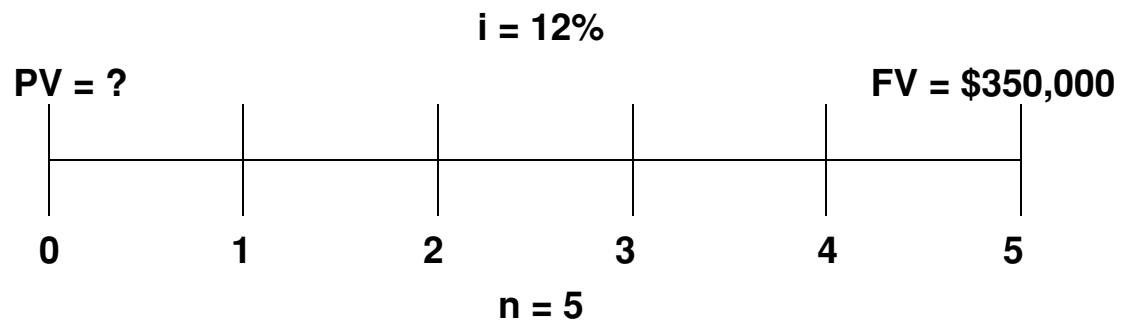
$$\$200,000 = R (16.72201)$$

$$\frac{\$200,000}{16.72201} = R$$

$$R = \$11,960$$

## BRIEF EXERCISE 6-7

12% annual interest



$$PV = \$350,000 (PVF_{5, 12\%})$$

$$PV = \$350,000 (.56743)$$

$$PV = \$198,600.50$$

## BRIEF EXERCISE 6-8

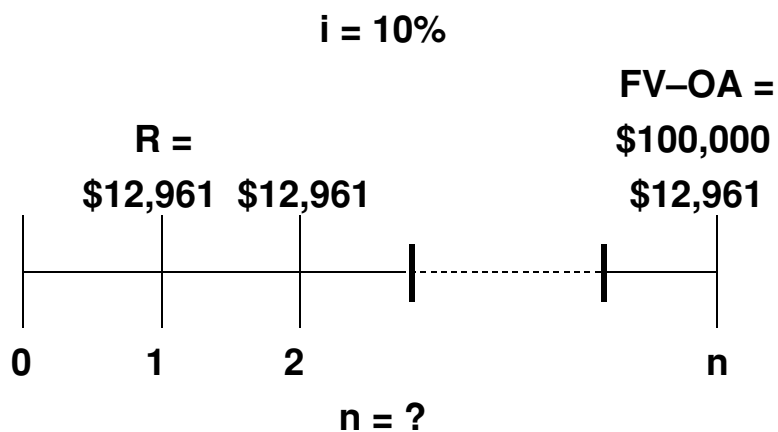
With quarterly compounding, there will be 20 quarterly compounding periods, at 1/4 the interest rate:

$$PV = \$350,000 (PVF_{20, 3\%})$$

$$PV = \$350,000 (.55368)$$

$$PV = \$193,788$$

## BRIEF EXERCISE 6-9



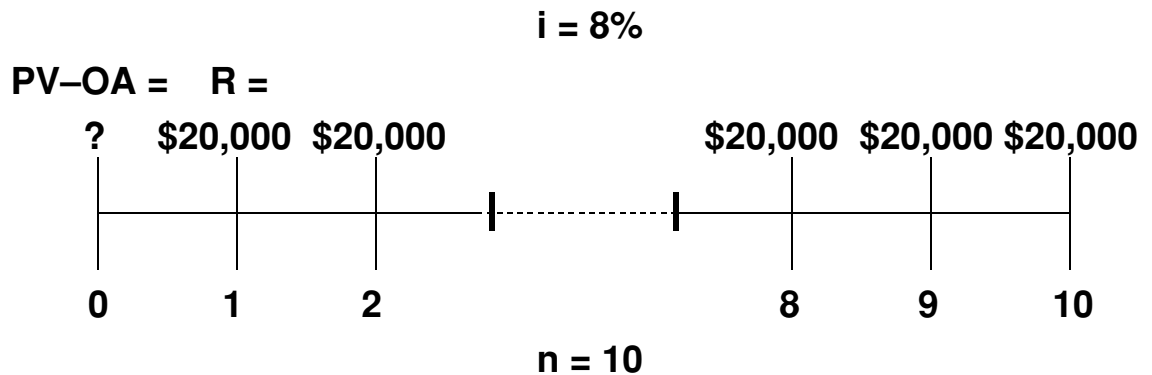
$$\$100,000 = \$12,961 (FVF-OA_{n, 10\%})$$

$$FVF-Oa_{n, 10\%} = \frac{\$100,000}{12,961} = 7.71545$$

Therefore,  $n = 6$  years

## BRIEF EXERCISE 6-10

### First withdrawal at year-end

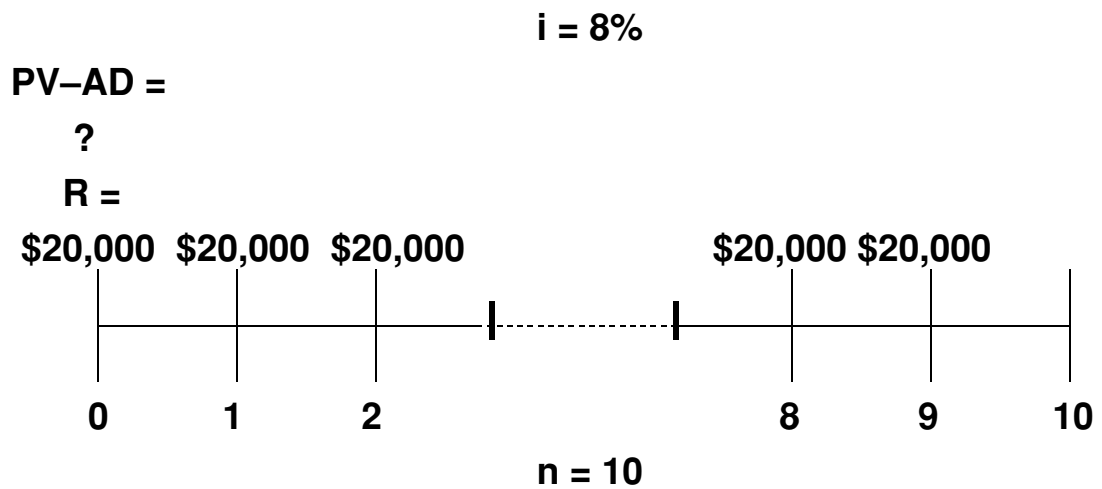


$$PV-OA = \$20,000 (PVF-OA_{10, 8\%})$$

$$PV-OA = \$20,000 (6.71008)$$

$$PV-OA = \$134,202$$

### First withdrawal immediately

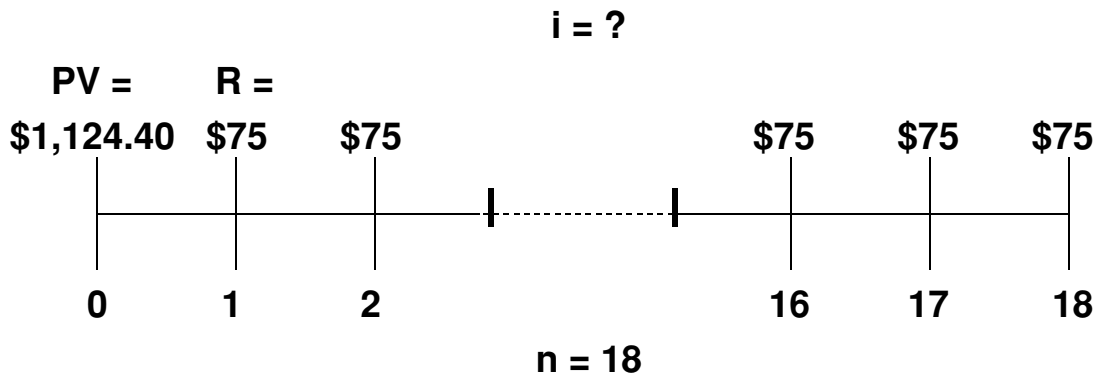


$$PV-AD = \$20,000 (PVF-AD_{10, 8\%})$$

$$PV-AD = \$20,000 (7.24689)$$

$$PV-AD = \$144,938$$

### BRIEF EXERCISE 6-11

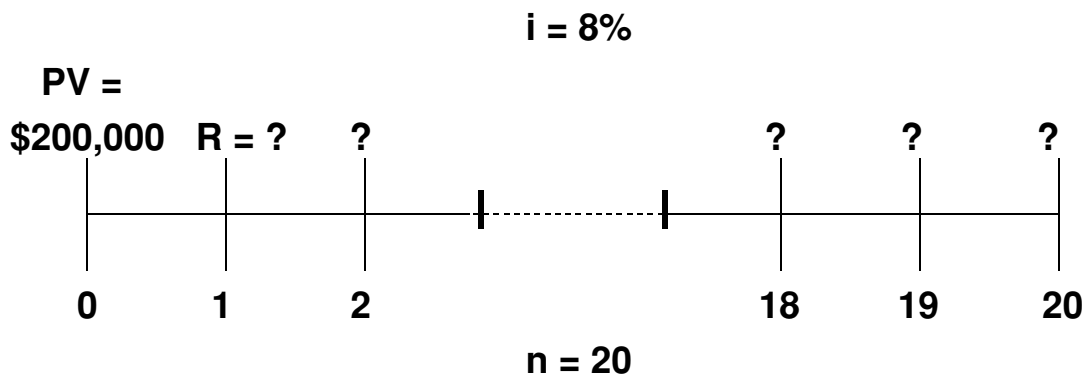


$$\$1,124.40 = \$75 (\text{PVF-}OA_{18, i})$$

$$\text{PVF}_{18, i} = \frac{\$1,124.40}{75} = 14.992$$

Therefore,  $i = 2\%$  per month

### BRIEF EXERCISE 6-12

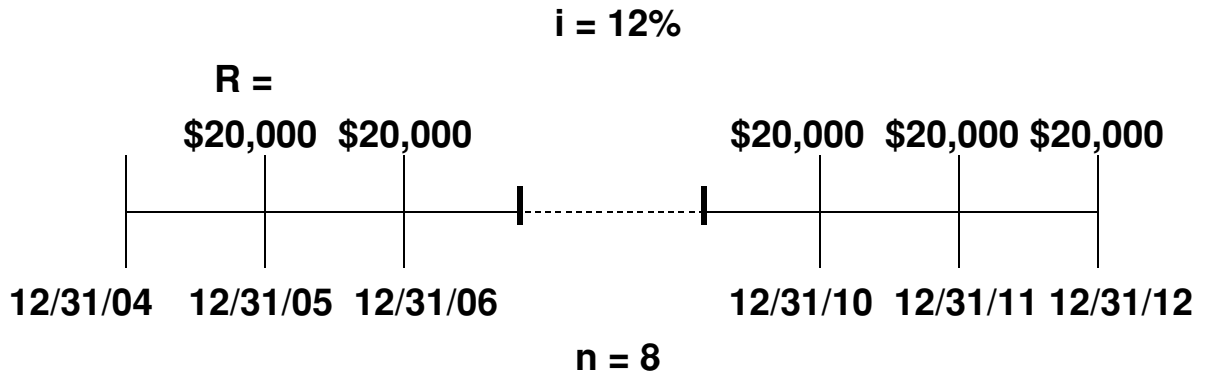


$$\$200,000 = R (\text{PVF-}OA_{20, 8\%})$$

$$\$200,000 = R (9.81815)$$

$$R = \$20,370$$

**BRIEF EXERCISE 6-13**

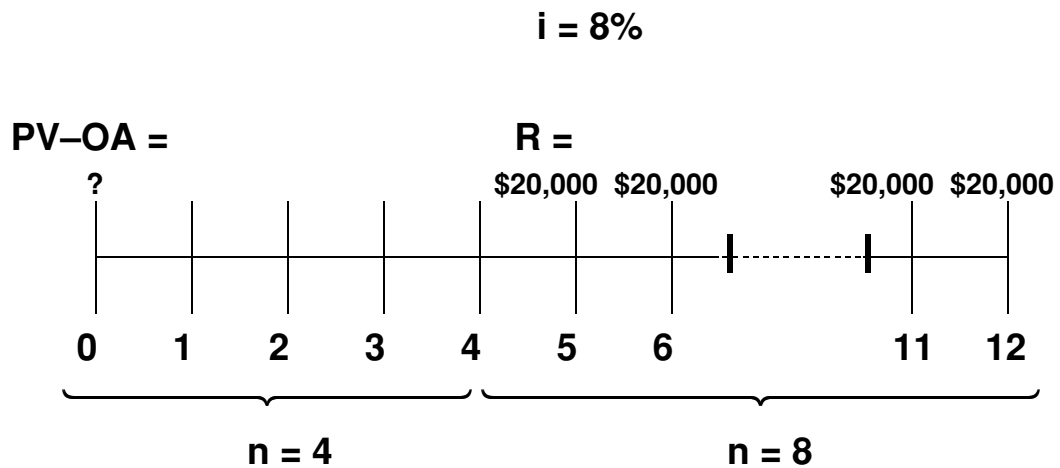


$$FV-OA = \$20,000 (FVF-OA_{8, 12\%})$$

$$FV-OA = \$20,000 (12.29969)$$

$$FV-OA = \$245,994$$

**BRIEF EXERCISE 6-14**



$$PV-OA = \$20,000 (PVF-OA_{12-4, 8\%})$$

$$PV-OA = \$20,000 (PVF-OA_{8, 8\%})(PVF_{4, 8\%})$$

OR

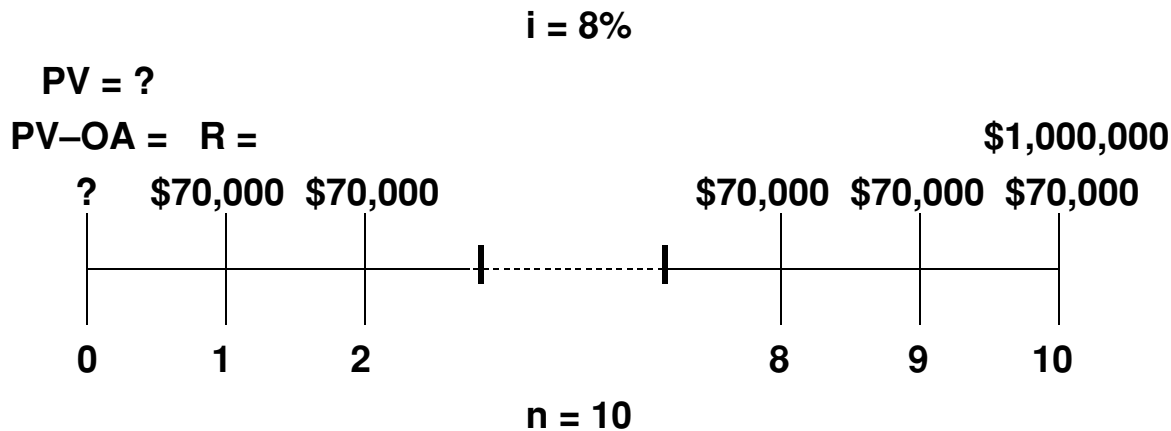
$$PV-OA = \$20,000 (7.53608 - 3.31213)$$

$$PV-OA = \$20,000 (5.74664)(.73503)$$

$$PV-OA = \$84,479$$

$$PV-OA = \$84,479$$

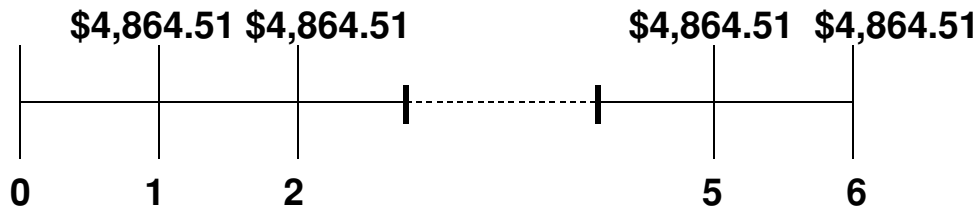
## BRIEF EXERCISE 6-15



$$\begin{array}{r}
 \$1,000,000 (PVF_{10, 8\%}) = \$1,000,000 (.46319) = \$463,190 \\
 70,000 (PVF-OA_{10, 8\%}) = \$70,000 (6.71008) \quad \underline{469,706} \\
 \hline
 \underline{\underline{\$932,896}}
 \end{array}$$

## BRIEF EXERCISE 6-16

$PV-OA = \$20,000$

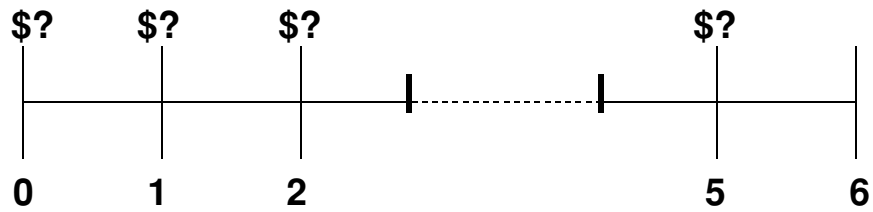


$$\begin{array}{r}
 \$20,000 = \$4,864.51 (PV-OA_{6, i\%}) \\
 (PV-OA_{6, i\%}) = \$20,000 \div \$4,864.51 \\
 (PV-OA_{6, i\%}) = 4.1114 \\
 \text{Therefore, } i\% = 12
 \end{array}$$



## BRIEF EXERCISE 6-17

**PV-OA = \$20,000**



$$\mathbf{\$20,000 = \text{Payment} (PV-AD_{6, 12\%})}$$

$$\mathbf{\$20,000 \div (PV-AD_{6, 12\%}) = \text{Payment}}$$

$$\mathbf{\$20,000 \div 4.60478 = \$4,343.31}$$

# SOLUTIONS TO EXERCISES

## EXERCISE 6-1 (5-10 minutes)

		<u>Rate of Interest</u>	<u>Number of Periods</u>
1.	a.	9%	9
	b.	3%	20
	c.	5%	30
2.	a.	9%	25
	b.	5%	30
	c.	3%	28

## EXERCISE 6-2 (5-10 minutes)

	<u>Cash Flow</u>	<u>Probability</u>	<u>Assessment =</u>	<u>Expected Cash Flow</u>
(a)	\$ 3,800	20%		\$ 760
	6,300	50%		3,150
	7,500	30%		<u>2,250</u>
		<b>Total Expected</b>		
		Value		<u><b>\$6,160</b></u>
(b)	\$ 5,400	30%		\$ 1,620
	7,200	50%		3,600
	8,400	20%		<u>1,680</u>
		<b>Total Expected</b>		
		Value		<u><b>\$6,900</b></u>

### EXERCISE 6-2 (Continued)

3. \$(1,000)	10%	\$ -100
2,000	80%	1,600
5,000	10%	<u>500</u>
Total Expected		
Value		<u>\$2,000</u>

### EXERCISE 6-3 (10-15 minutes)

Estimated Cash Outflow X	Probability Assessment =	Expected Cash Flow	Present Value
\$ 200	10%	\$ 20	X PV
450	30%	135	Factor
550	50%	275	single sum,
750	10%	75	n = 2, I = 6%
		<u>\$ 505</u>	X 0.89
			<u>\$ 449.45</u>

### EXERCISE 6-4 (5-10 minutes)

(a) Simple interest of \$1,600 per year X 8	\$12,800
Principal	<u>20,000</u>
Total withdrawn	<u>\$32,800</u>
 (b) Interest compounded annually—Future value of 1 @ 8% for 8 periods	1.85093
	X <u>\$20,000</u>
Total withdrawn	<u>\$37,018.60</u>

### EXERCISE 6-4 (Continued)

(c) Interest compounded semiannually—Future value of 1 @ 4% for 16 periods	1.87298
	<u>X \$20,000</u>
Total withdrawn	<u>\$37,459.60</u>

### EXERCISE 6-5 (10-15 minutes)

- (a)  $\$7,000 \times 1.46933 = \$10,285.31.$
- (b)  $\$7,000 \times .43393 = \$3,037.51.$
- (c)  $\$7,000 \times 31.77248 = \$222,407.36.$
- (d)  $\$7,000 \times 12.46221 = \$87,235.47.$

### EXERCISE 6-6 (15-20 minutes)

(a) Future value of an ordinary annuity of \$4,000 a period for 20 periods at 8%	\$183,047.8	(\$4,000 X 45.76196)
Factor (1 + .08)	<u>X 1.08</u>	
Future value of an annuity due of \$4,000 a period at 8%	<u>\$197,691.66</u>	

## EXERCISE 6-6 (Continued)

- (b) Present value of an ordinary annuity of \$2,500 for 30 periods at 10% \$23,567.28 (\$2,500 X 9.42691)  
Factor (1 + .10) X 1.10  
Present value of annuity due of \$2,500 for 30 periods at 10% \$25,924.00 (Or see Table 6-5 which gives \$25,924.03)
- (c) Future value of an ordinary annuity of \$2,000 a period for 15 periods at 10% \$63,544.96 (\$2,000 X 31.77248)  
Factor (1 + .10) X 1.10  
Future value of an annuity due of \$2,000 a period for 15 periods at 10% \$69,899.46
- (d) Present value of an ordinary annuity of \$1,000 for 6 periods at 9% \$4,485.92 (\$1,000 X 4.48592)  
Factor (1 + .09) X 1.09  
Present value of an annuity due of \$1,000 for 6 periods at 9% \$4,889.65 (Or see Table 6-5)

## EXERCISE 6-7 (10-15 minutes)

- (a)  $\$30,000 \times 4.96764 = \$149,029.20.$
- (b)  $\$30,000 \times 8.31256 = \$249,376.80.$
- (c)  $(\$30,000 \times 3.03735 \times .50663 = \$46,164.38.$   
or  $(5.65022 - 4.11141) \times \$30,000 = \$46,164.30$  (difference of \$.08 due to rounding).

**EXERCISE 6-8 (15-20 minutes)**

(a) Future value of \$12,000 @ 10% for 10 years  
( $\$12,000 \times 2.59374$ ) = **\$31,124.88**

(b) Future value of an ordinary annuity of \$600,000  
at 10% for 15 years ( $\$600,000 \times 31.77248$ ) **\$19,063,488.00**

Deficiency ( $\$20,000,000 - \$19,063,488$ ) **\$936,512.00**

(c) \$70,000 discounted at 8% for 10 years:  
 $\$70,000 \times .46319 =$  **\$32,423.30**

Accept the bonus of \$40,000 now.

(Also, consider whether the 8% is an appropriate discount rate since the president can probably earn compound interest at a higher rate without too much additional risk.)

**EXERCISE 6-9 (12-17 minutes)**

(a)  $\$50,000 \times .31524 = \$15,762.00$   
 $+ \$5,000 \times 8.55948 = \underline{42,797.40}$   
**\$58,559.40**

(b)  $\$50,000 \times .23939 = \$11,969.50$   
 $+ \$5,000 \times 7.60608 = \underline{38,030.40}$   
**\$49,999.90**

The answer should be \$50,000; the above computation is off by 10¢ due to rounding.

(c)  $\$50,000 \times .18270 = \$ 9,135.00$   
 $+ \$5,000 \times 6.81086 = \underline{34,054.30}$   
**\$43,189.30**

### EXERCISE 6-10 (10-15 minutes)

- (a) Present value of an ordinary annuity of 1  
for 4 periods @ 8% 3.31213  
Annual withdrawal X \$20,000  
Required fund balance on June 30, 2010 \$66,242.60
- (b) Fund balance at June 30, 2010 \$66,242.60  
Future amount of ordinary annuity at 8% 4.50611 = \$14,700.62  
for 4 years

Amount of each of four contributions is \$14,700.62

### EXERCISE 6-11 (10 minutes)

The rate of interest is determined by dividing the future value by the present value and then find the factor in the FVF table with  $n = 2$  that approximate that number:

$$\$123,210 = \$100,000 (FVF_{2, i\%})$$

$$\$123,210 \div \$100,000 = (FVF_{2, i\%})$$

1.2321 =  $(FVF_{2, i\%})$ —reading across the  $n = 2$  row reveals that  $i = 11\%$ .

### EXERCISE 6-12 (10-15 minutes)

- (a) The number of interest periods is calculated by first dividing the future value of \$1,000,000 by \$92,296, which is 10.83471—the value \$1.00 would accumulate to at 10% for the unknown number of interest periods. The factor 10.83471 or its approximate is then located in the Future value of 1 Table by reading down the 10% column to the 25-period line; thus, 25 is the unknown number of years Mike must wait to become a millionaire.
- (b) The unknown interest rate is calculated by first dividing the future value of \$1,000,000 by the present investment of \$182,696, which is 5.47357—the amount \$1.00 would accumulate to in 15 years at an unknown interest rate. The factor or its approximate is then located in the Future value of 1 Table by reading across the 15-period line to the 12% column; thus, 12% is the interest rate Venus must earn on her investment to become a millionaire.

**EXERCISE 6-13 (10-15 minutes)**

(a) Total interest = Total Payments—Amount owed today  
 $\$162,745.30 (10 \times \$16,274.53) - \$100,000 = \$62,745.30.$

(b) Sosa should borrow from the bank, since the 9% rate is lower than the manufacturer's 10% rate determined below.

$$\begin{aligned} PV-OA_{10, i\%} &= \$100,000 \div \$16,274.53 \\ &= 6.14557 \text{—Inspection of the 10 period row reveals a rate of} \\ &\quad 10\%. \end{aligned}$$

**EXERCISE 6-14 (10-15 minutes)**

Building A—PV = \$600,000.

Building B—

$$\begin{aligned} \text{Rent X (PV of annuity due of 25 periods at 12\%)} &= \text{PV} \\ \$69,000 \times 8.78432 &= \text{PV} \\ \$606,118.08 &= \text{PV} \end{aligned}$$

Building C—

$$\begin{aligned} \text{Rent X (PV of ordinary annuity of 25 periods at 12\%)} &= \text{PV} \\ \$7,000 \times 7.84314 &= \text{PV} \\ \$54,901.98 &= \text{PV} \end{aligned}$$

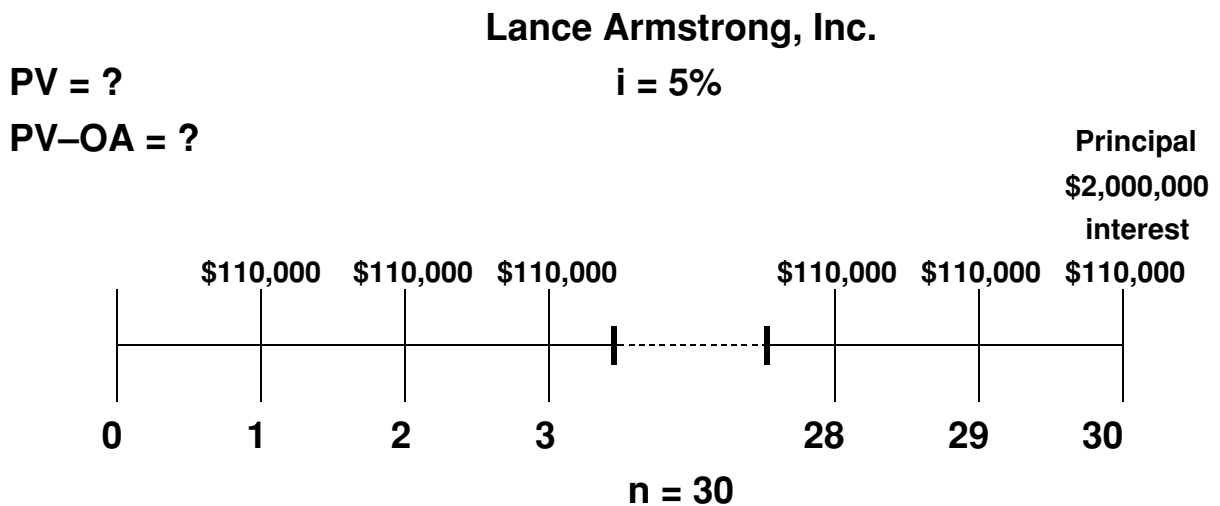
Cash purchase price of	\$650,000.00
PV of rental income	<u>– 54,901.98</u>
Net present value	<u>\$595,098.02</u>

**Answer:** Lease Building C since its present value of its net cost is the smallest.



## EXERCISE 6-15 (15-20 minutes)

Time diagram:



Formula for the interest payments:

$$PV-OA = R (PVF-OA_{n, i})$$

$$PV-OA = \$110,000 (PVF-OA_{30, 5\%})$$

$$PV-OA = \$110,000 (15.37245)$$

$$PV-OA = \underline{\underline{\$1,690,970}}$$

Formula for the principal:

$$PV = FV (PVF_{n, i})$$

$$PV = \$2,000,000 (PVF_{30, 5\%})$$

$$PV = \$2,000,000 (0.23138)$$

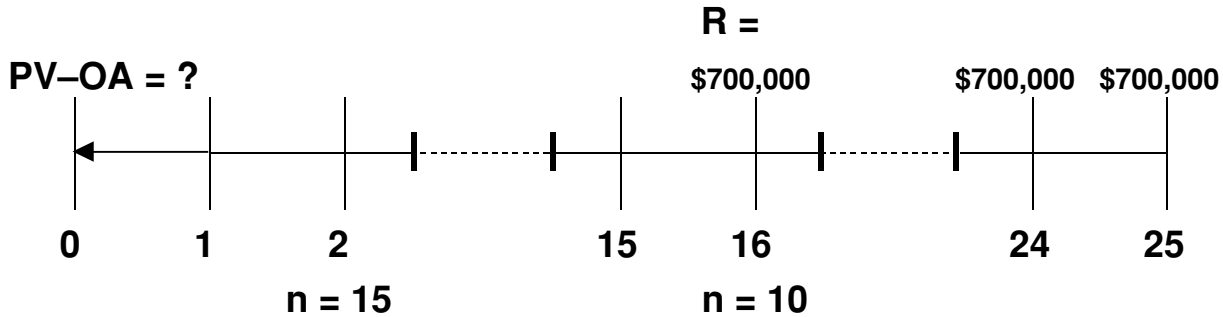
$$PV = \underline{\underline{\$462,760}}$$

The selling price of the bonds =  $\$1,690,970 + \$462,760 = \$2,153,730$ .

**EXERCISE 6-16 (15-20 minutes)**

**Time diagram:**

$i = 8\%$



**Formula:**  $PV-OA = R (PVF-OA_{n,i})$

$$PV-OA = \$700,000 (PVF-OA_{25-15, 8\%})$$

$$PV-OA = \$700,000 (10.67478 - 8.55948)$$

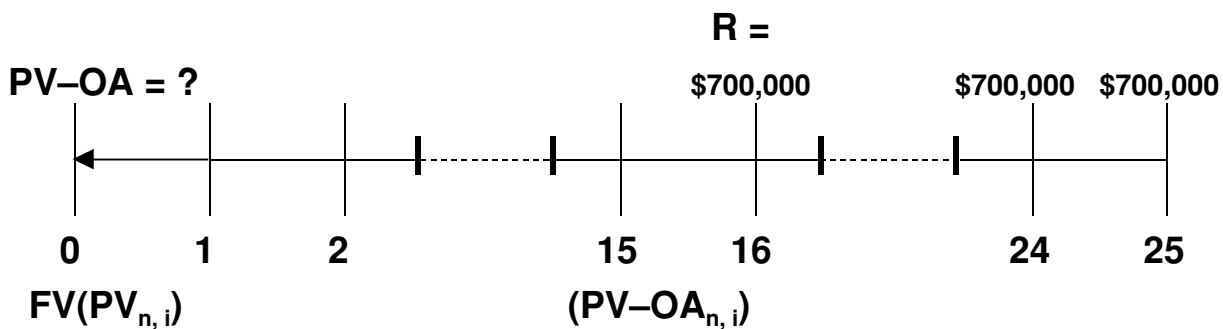
$$PV-OA = \$700,000 (2.11530)$$

$$PV-OA = \underline{\underline{\$1,480,710}}$$

**OR**

**Time diagram:**

$i = 8\%$



## EXERCISE 6-16 (Continued)

- (i) Present value of the expected annual pension payments at the end of the 15<sup>th</sup> year:

$$PV-OA = R (PVF-OA_{n, i})$$

$$PV-OA = \$700,000 (PVF-OA_{10, 8\%})$$

$$PV-OA = \$700,000 (6.71008)$$

$$PV-OA = \underline{\$4,697,056}$$

- (ii) Present value of the expected annual pension payments at the beginning of the current year:

$$PV = FV (PVF-OA_{n, i})$$

$$PV = \$4,697,056 (PVF-OA_{15, 8\%})$$

$$PV = \$4,697,056 (0.31524)$$

$$PV = \underline{\$1,480,700^*}$$

\*\$10 difference due to rounding.

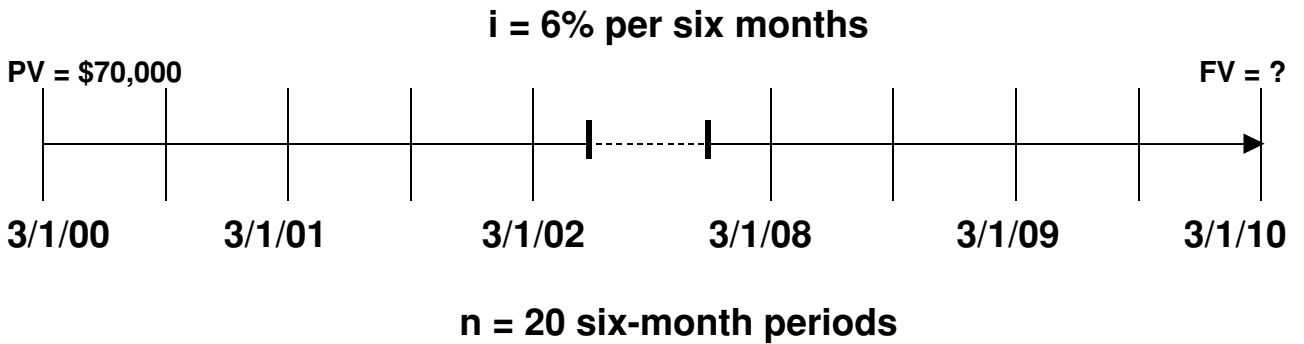
The company's pension obligation (liability) is \$1,480,700.



**EXERCISE 6-18 (10-15 minutes)**

**Amount to be repaid on March 1, 2010.**

**Time diagram:**



**Formula:  $FV = PV (FVF_{n,i})$**

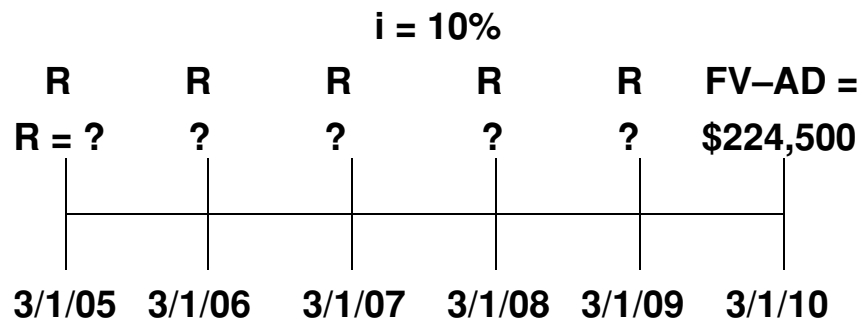
$$FV = \$70,000 (FVF_{20,6\%})$$

$$FV = \$70,000 (3.20714)$$

$$FV = \underline{\underline{\$224,500}}$$

**Amount of annual contribution to retirement fund.**

**Time diagram:**

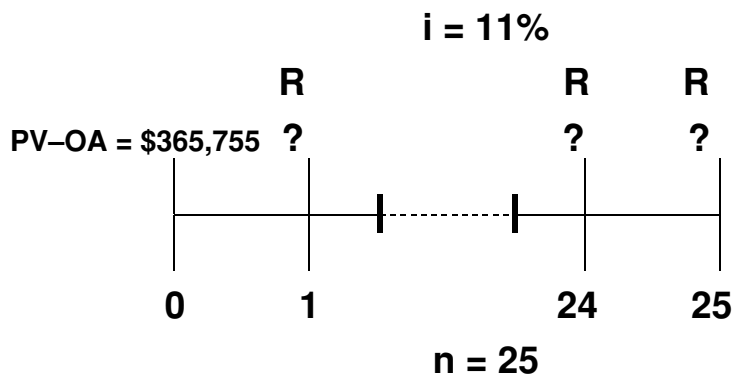


### EXERCISE 6-18 (Continued)

1. Future value of ordinary annuity of 1 for 5 periods at 10%	6.10510
2. Factor (1 + .10)	X <u>1.10000</u>
3. Future value of an annuity due of 1 for 5 periods at 10%	<u>6.71561</u>
4. Periodic rent (\$224,500 ÷ 6.71561)	<u>\$33,430</u>

### EXERCISE 6-19 (10-15 minutes)

Time diagram:



Formula:  $PV-OA = R (PV-OA_{n, i})$

$$\$365,755 = R (PVF-OA_{25, 11\%})$$

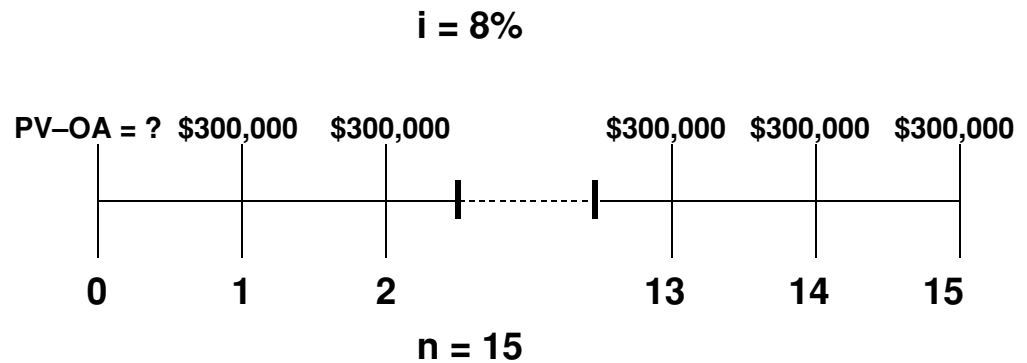
$$\$365,755 = R (8.42174)$$

$$R = \$365,755 \div 8.42174$$

$$R = \underline{\underline{\$43,429.86}}$$

## EXERCISE 6-20 (10-15 minutes)

Time diagram:



Formula:  $PV-OA = R (PVF-OA_{n, i})$

$$PV-OA = \$300,000 (PVF-OA_{15, 8\%})$$

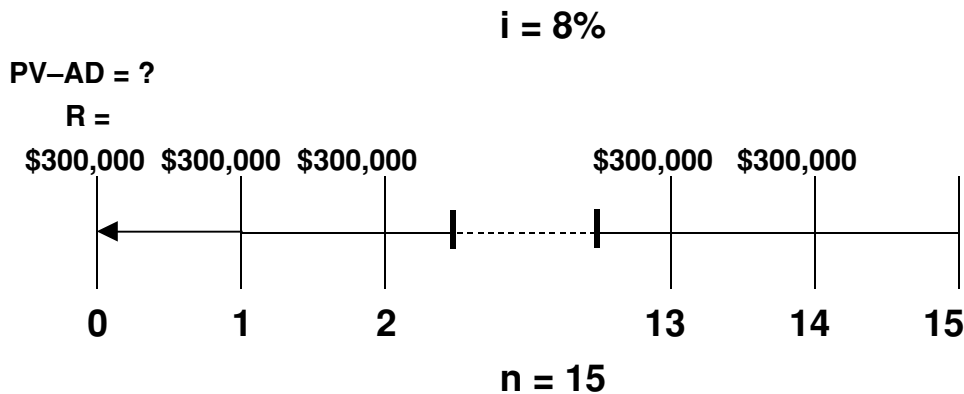
$$PV-OA = \$300,000 (8.55948)$$

$$R = \underline{\underline{\$2,567,844}}$$

The recommended method of payment would be the 15 annual payments of \$300,000, since the present value of those payments (\$2,567,844) is less than the alternative immediate cash payment of \$2,600,000.

**EXERCISE 6-21 (10-15 minutes)**

**Time diagram:**



**Formula:**

Using Table 6-4

$$PV-AD = R (PVF-OA_{n,i})$$

$$PV-AD = \$300,000 (8.55948 \times 1.08)$$

$$PV-AD = \$300,000 (9.24424)$$

$$PV-AD = \underline{\underline{\$2,773,272}}$$

Using Table 6-5

$$PV-AD = R (PVF-AD_{n,i})$$

$$PV-AD = \$300,000 (PVF-AD_{15, 8\%})$$

$$PV-AD = \$300,000 (9.24424)$$

$$PV-AD = \underline{\underline{\$2,773,272}}$$

The recommended method of payment would be the immediate cash payment of \$2,600,000, since that amount is less than the present value of the 15 annual payments of \$300,000 (\$2,773,272).

**\*EXERCISE 6-22**

10	?	-19,000	0	49,000
N	I/YR.	PV	PMT	FV
	9.94%			



**\*EXERCISE 6-23**

10	?	42,000	6,500	0
N	I/YR.	PV	PMT	FV
	8.85%			

**\*EXERCISE 6-24**

40	?	178,000	14,000	0
N	I/YR.	PV	PMT	FV
	7.49%			
	(semiannual)			

# TIME AND PURPOSE OF PROBLEMS

## **Problem 6-1** (Time 15-20 minutes)

Purpose—to present an opportunity for the student to determine how to use the present value tables in various situations. Each of the situations presented emphasizes either a present value of 1 or a present value of an ordinary annuity situation. Two of the situations will be little more difficult for the student because a noninterest-bearing note and bonds are involved.

## **Problem 6-2** (Time 15-20 minutes)

Purpose—to present an opportunity for the student to determine solutions to four present and future value situations. The student is required to determine the number of years over which certain amounts will accumulate, the rate of interest required to accumulate a given amount, and the unknown amount of periodic payments. The problem develops the student's ability to set up present and future value equations and solve for unknown quantities.

## **Problem 6-3** (Time 20-30 minutes)

Purpose—to present the student with an opportunity to determine the future value of a series of deposits. The student is required to deal with the future value of an annuity due and the future value of a single sum. The problem presents a situation where interest rates change during the annuity period.

## **Problem 6-4** (Time 20-30 minutes)

Purpose—to present the student with an opportunity to determine the present value of the costs of competing contracts. Each situation requires application of a present value of an amount of 1 factor and a present value of an annuity factor. The student is required to decide on the contract to be accepted.

## **Problem 6-5** (Time 20-25 minutes)

Purpose—to provide the student with an opportunity to determine which of four insurance options results in the largest present value. The student is required to determine the present value of options which include the immediate receipt of cash, an ordinary annuity, an annuity due, and an annuity of changing amount. The student must also deal with interest compounded quarterly. This problem is a good summary of the application of present value techniques.

## **Problem 6-6** (Time 20-25 minutes)

Purpose—to present the student an opportunity to compute expected cash flows and then apply present value techniques to determine a warranty liability.

## **Problem 6-7** (Time 20-25 minutes)

Purpose—to present the student an opportunity to compute expected cash flows and then apply present value techniques to determine the fair value of an asset.

## **Problem 6-8** (Time 25-30 minutes)

Purpose—to present an opportunity for the student to determine the present value of a series of deferred annuities. The student must deal with both cash inflows and outflows to arrive at a present value of net cash inflows. A good problem to develop the student's ability to manipulate the present value table factors to efficiently solve the problem.

## **Problem 6-9** (Time 30-35 minutes)

Purpose—to present the student an opportunity to use time value concepts in business situations. Some of the situations are fairly complex and will require the student to think a great deal before answering the question. For example, in one situation a student must discount a note and in another must find the proper interest rate to use in a purchase transaction.

## **Time and Purpose of Problems (Continued)**

### **Problem 6-10** (Time 20-30 minutes)

Purpose—to present the student with an opportunity to determine the present value of an ordinary annuity and annuity due for three different cash payment situations. The student must then decide which cash payment plan should be undertaken.

### **Problem 6-11** (Time 30-35 minutes)

Purpose—to present the student with the opportunity to work three different problems related to time value concepts: purchase versus lease, determination of fair value of a note, and appropriateness of taking a cash discount.

### **Problem 6-12** (Time 30-35 minutes)

Purpose—to present the student with the opportunity to assess whether a company should purchase or lease. The computations for this problem are relatively complicated.

### **Problem 6-13** (Time 25-30 minutes)

Purpose—to present the student an opportunity to apply present value to retirement funding problems, including deferred annuities.

### **Problem 6-14** (Time 20-25 minutes)

Purpose—to provide the student an opportunity to explore the ethical issues inherent in applying time value of money concepts to retirement plan decisions.

### **\*Problems 6-15, 6-16, 6-17** (Time 10-15 minutes each)

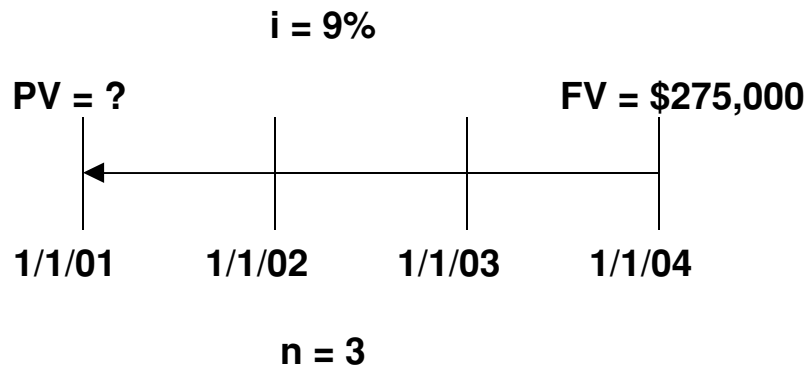
Purpose—to present the student an opportunity to use a financial calculator to solve time value of money problems.

# SOLUTIONS TO PROBLEMS

## PROBLEM 6-1

- (a) Given no established value for the building, the fair market value of the note would be estimated to value the building.

Time diagram:



Formula:  $PV = FV (PVF_{n, i})$

$$PV = \$275,000 (PVF_{3, 9\%})$$

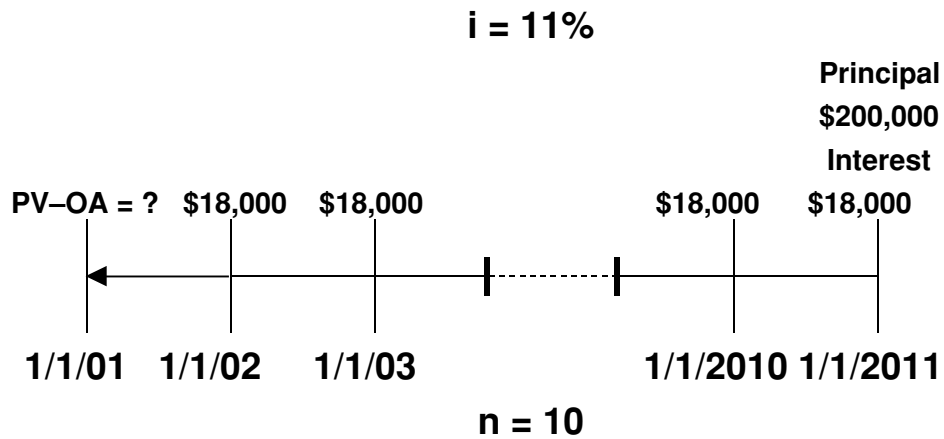
$$PV = \$275,000 (.77218)$$

$$PV = \underline{\underline{\$212,349.50}}$$

Cash equivalent price of building	\$212,349.50
Less book value (\$250,000 – \$100,000)	<u>150,000.00</u>
Gain on disposal of the building	<u><u>\$ 62,349.50</u></u>

**PROBLEM 6-1 (Continued)**

**(b) Time diagram:**



**Present value of the principal**

$$FV (PVF_{10, 11\%}) = \$200,000 (.35218) = \$ 70,436.00$$

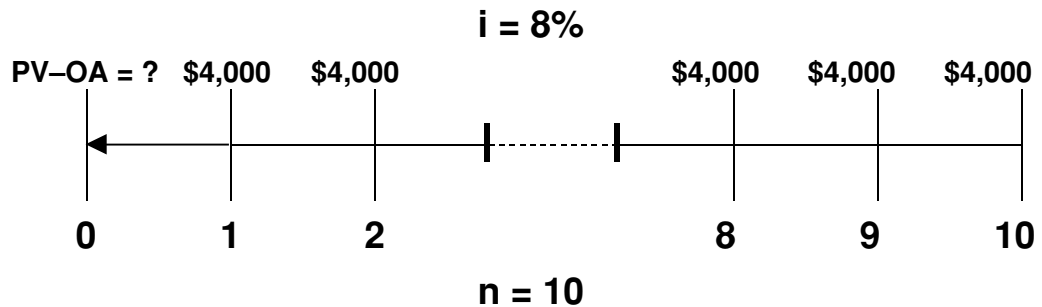
**Present value of the interest payments**

$$R (PVF-OA_{10, 11\%}) = \$18,000 (5.88923) = \underline{106,006.14}$$

**Combined present value (purchase price)**

$$\underline{\underline{\$176,442.14}}$$

**(c) Time diagram:**



**Formula:**  $PV-OA = R (PVF-OA_{n,i})$

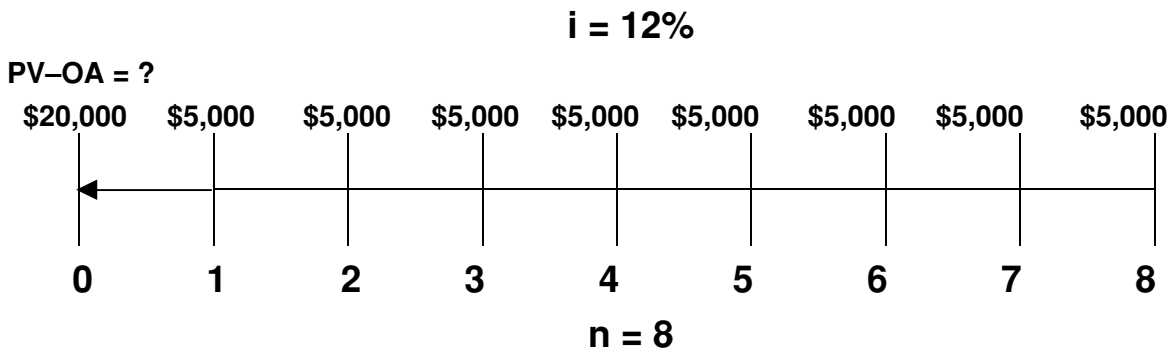
$$PV-OA = \$4,000 (PVF-OA_{10, 8\%})$$

$$PV-OA = \$4,000 (6.71008)$$

$$PV-OA = \underline{\underline{\$26,840.32}} \text{ (cost of machine)}$$

**PROBLEM 6-1 (Continued)**

**(d) Time diagram:**



**Formula:**  $PV-OA = R (PVF-OA_{n,i})$

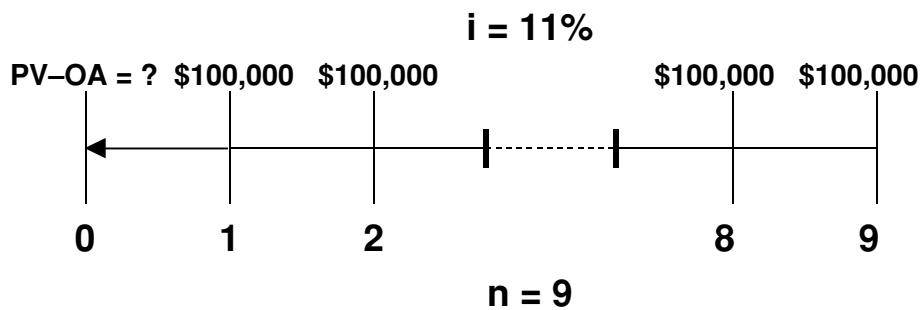
$$PV-OA = \$5,000 (PVF-OA_{8, 12\%})$$

$$PV-OA = \$5,000 (4.96764)$$

$$PV-OA = \underline{\underline{\$24,838.20}}$$

$$\text{Cost of machine} = \$20,000 + \$24,838.20 = \underline{\underline{\$44,838.20}}$$

**(e) Time diagram:**



**Formula:**  $PV-OA = R (PVF-OA_{n,i})$

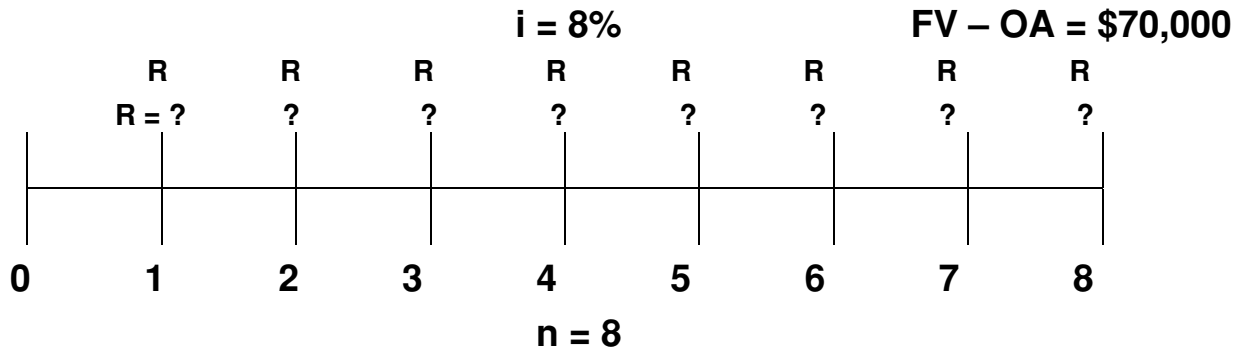
$$PV-OA = \$100,000 (PVF-OA_{9, 11\%})$$

$$PV-OA = \$100,000 (5.53705)$$

$$PV-OA = \underline{\underline{\$553,705}}$$

**PROBLEM 6-2**

(a) Time diagram:



Formula:  $FV-OA = R (FVF-OA_{n,i})$

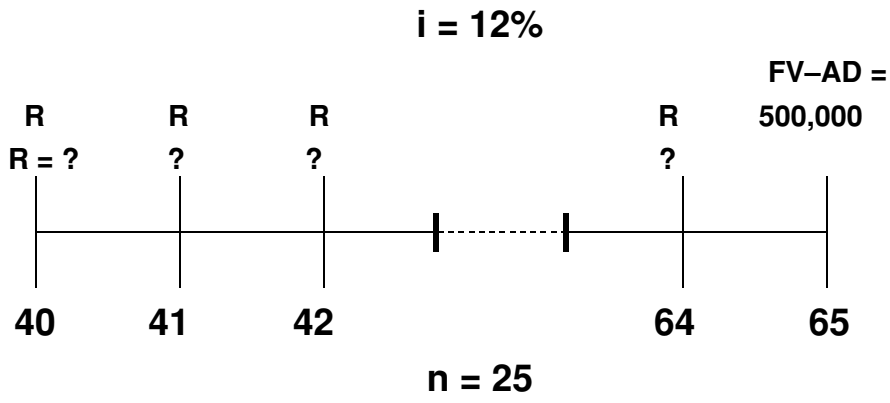
$$\$70,000 = R (FVF-OA_{8, 8\%})$$

$$\$70,000 = R (10.63663)$$

$$R = \$70,000 \div 10.63663$$

$$R = \underline{\underline{\$6,581.03}}$$

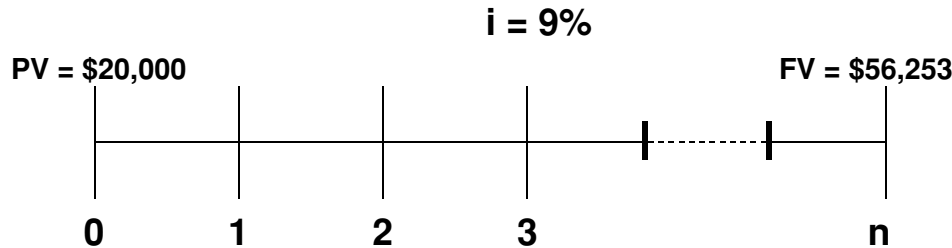
(b) Time diagram:



**PROBLEM 6-2 (Continued)**

1. Future value of an ordinary annuity of 1 for 25 periods at 12%	133.33387
2. Factor (1 + .12)	<u>1.1200</u>
3. Future value of an annuity due of 1 for 25 periods at 12%	<u>149.33393</u>
4. Periodic rent (\$500,000 ÷ 149.33393)	<u>\$3,348.20</u>

(c) Time diagram:



Future value approach

$$FV = PV (FVF_{n,i})$$

$$\$56,253 = \$20,000 (FVF_{n,9\%})$$

$$FVF_{n,9\%} = \frac{\$56,253}{\$20,000} = \underline{2.81265}$$

2.81265 is approximately the value of \$1 invested at 9% for 12 years.

Present value approach

$$PV = FV (PVF_{n,i})$$

$$\$20,000 = \$56,253 (PVF_{n,9\%})$$

$$PVF_{n,9\%} = \frac{\$20,000}{\$56,253} = \underline{.35554}$$

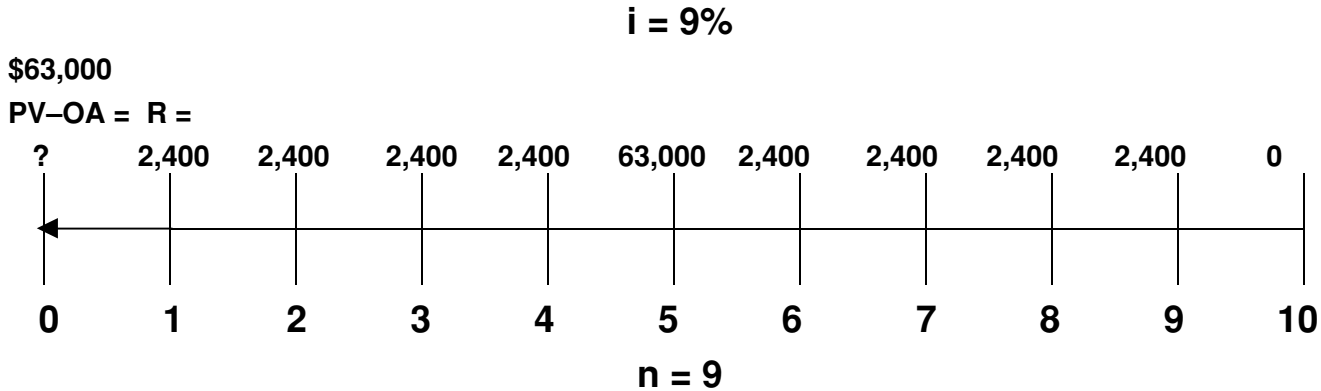
.35554 is approximately the present value of \$1 discounted at 9% for 12 years.





**PROBLEM 6-3**

**Time diagram (Bid A):**



**Present value of initial cost**

$$12,000 \times \$5.25 = \underline{\$63,000} \text{ (incurred today)} \qquad \qquad \qquad \$ 63,000.00$$

**Present value of maintenance cost (years 1-4)**

$$12,000 \times \$0.20 = \underline{\$2,400}$$

$$R (PVF-OA_{4, 9\%}) = \$2,400 (3.23972) \qquad \qquad \qquad 7,775.33$$

**Present value of resurfacing**

$$FV (PVF_{5, 9\%}) = \$63,000 (.64993) \qquad \qquad \qquad 40,945.59$$

**Present value of maintenance cost (years 6-9)**

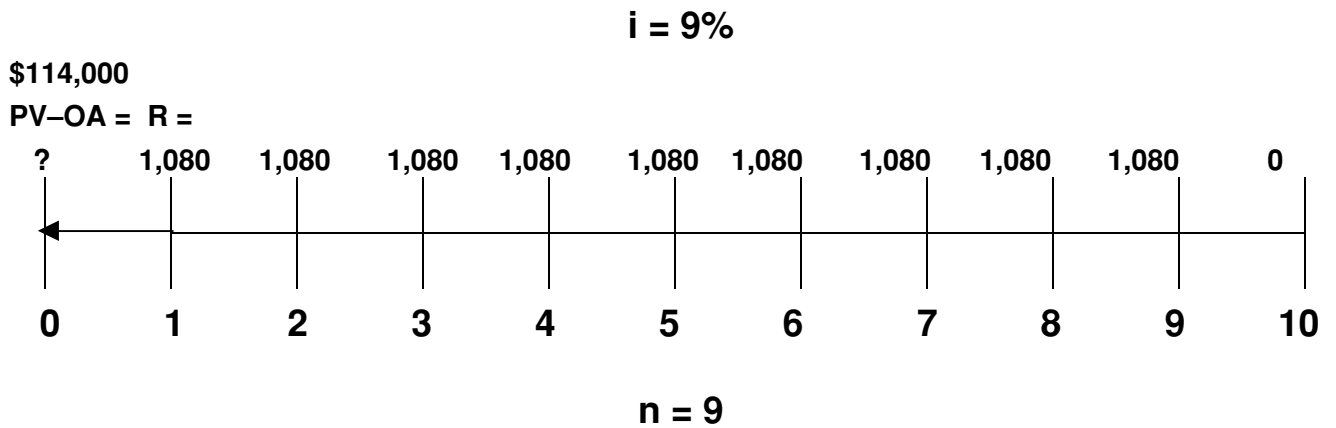
$$R (PVF-OA_{9-5, 9\%}) = \$2,400 (5.99525 - 3.88965) \qquad \qquad \underline{\underline{5,053.44}}$$

**Present value of outflows for Bid A**

**\$116,774.36**

**PROBLEM 6-3 (Continued)**

**Time diagram (Bid B):**



**Present value of initial cost**

$$12,000 \times \$9.50 = \$114,000 \text{ (incurred today)} \qquad \qquad \qquad \$114,000.00$$

**Present value of maintenance cost**

$$12,000 \times \$0.09 = \underline{\$1,080}$$

$$R (PV-OA_{9, 9\%}) = \$1,080 (5.99525) \qquad \qquad \qquad \underline{\underline{6,474.87}}$$

$$\text{Present value of outflows for Bid B} \qquad \qquad \qquad \underline{\underline{\$120,474.87}}$$

**Bid A should be accepted since its present value is the lower.**

**PROBLEM 6-4**

**Lump sum alternative: Present Value = \$900,000 X (1 – .46) = \$486,000.**

**Annuity alternative: Payments = \$62,000 X (1 – .25) = \$46,500.**

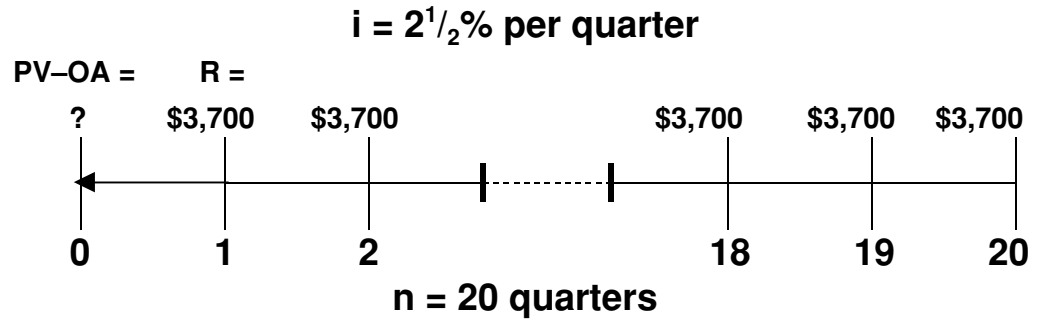
$$\begin{aligned}\text{Present Value} &= \text{Payments (PV-AD}_{20, 8\%}) \\ &= \$46,500 (10.60360) \\ &= \$493,067.40.\end{aligned}$$

**O'Malley should choose the annuity payout; its present value is \$7,067.40 greater.**

**PROBLEM 6-5**

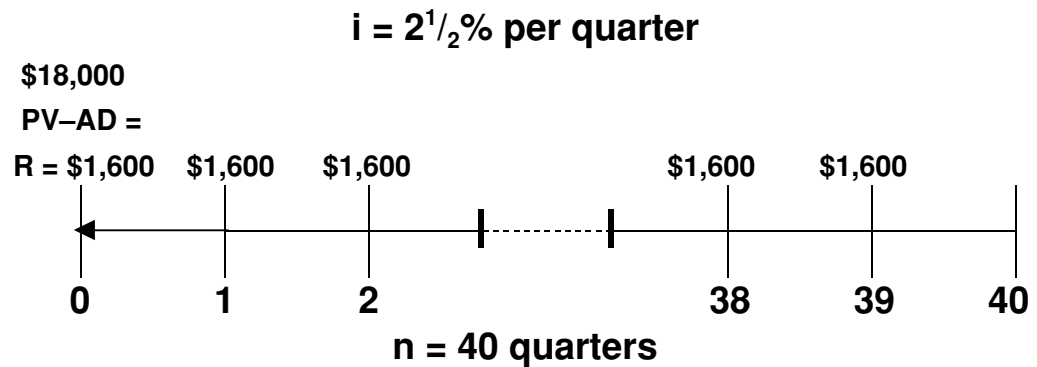
(a) The present value of \$55,000 cash paid today is \$55,000.

(b) Time diagram:



Formula:  $PV-OA = R (PVF-OA_{n, i})$   
 $PV-OA = \$3,700 (PVF-OA_{20, 2\frac{1}{2}\%})$   
 $PV-OA = \$3,700 (15.58916)$   
 $PV-OA = \underline{\underline{\$57,679.89}}$

(c) Time diagram:



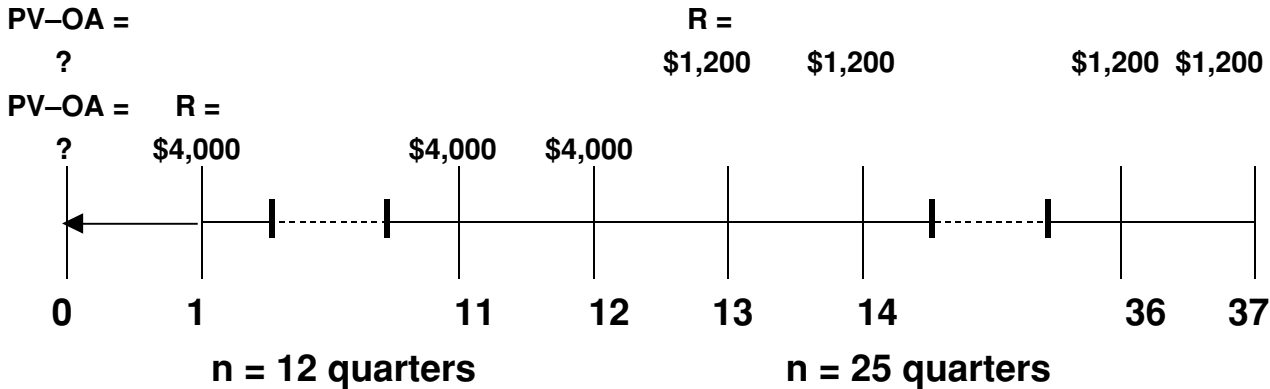
Formula:  $PV-AD = R (PVF-AD_{n, i})$   
 $PV-AD = \$1,600 (PVF-AD_{40, 2\frac{1}{2}\%})$   
 $PV-AD = \$1,600 (25.73034)$   
 $PV-AD = \underline{\underline{\$41,168.54}}$

The present value of option (c) is  $\$18,000 + \$41,168.54$ , or \$59,168.54.

**PROBLEM 6-5 (Continued)**

(d) Time diagram:

$i = 2\frac{1}{2}\%$  per quarter



**Formulas:**

$$PV-OA = R (PVF-OA_{n,i})$$

$$PV-OA = R (PVF-OA_{n,i})$$

$$PV-OA = \$4,000 (PVF-OA_{12, 2\frac{1}{2}\%})$$

$$PV-OA = \$1,200 (PVF-OA_{37-12, 2\frac{1}{2}\%})$$

$$PV-OA = \$4,000 (10.25776)$$

$$PV-OA = \$1,200 (23.95732 - 10.25776)$$

$$PV-OA = \underline{\underline{\$41,031.04}}$$

$$PV-OA = \underline{\underline{\$16,439.47}}$$

The present value of option (d) is  $\$41,031.04 + \$16,439.47$ , or **\$57,470.51**.

**Present values:**

(a) **\$55,000**.

(b) **\$57,679.89**.

(c) **\$59,168.54**.

(d) **\$57,470.51**.

**Option (c) is the best option, based upon present values alone.**

**PROBLEM 6-6**

	<b>Cash Flow</b>	<b>Probability</b>	<b>Assessment =</b>	<b>Expected Cash Flow</b>		
	<b>Estimate X</b>					
<b>2004</b>	<b>\$ 2,000</b>	<b>20%</b>	<b>\$ 400</b>			
	<b>4,000</b>	<b>60%</b>	<b>2,400</b>			
	<b>5,000</b>	<b>20%</b>	<b><u>1,000</u></b>		<b>X PV</b>	
					<b>Factor,</b>	
					<b>n = 1, I = 5%</b>	<b>Present Value</b>
			<b><u>\$ 3,800</u></b>		<b>0.95238</b>	<b><u>\$ 3,619.04</u></b>
<b>2005</b>	<b>\$ 2,500</b>	<b>30%</b>	<b>\$ 750</b>			
	<b>5,000</b>	<b>50%</b>	<b>2,500</b>			
	<b>6,000</b>	<b>20%</b>	<b><u>1,200</u></b>		<b>X PV</b>	
					<b>Factor,</b>	
					<b>n = 2, I = 5%</b>	<b>Present Value</b>
			<b><u>\$ 4,450</u></b>		<b>0.90703</b>	<b><u>\$ 4,036.28</u></b>
<b>2006</b>	<b>\$ 3,000</b>	<b>30%</b>	<b>\$ 900</b>			
	<b>6,000</b>	<b>40%</b>	<b>2,400</b>			
	<b>7,000</b>	<b>30%</b>	<b><u>2,100</u></b>		<b>X PV</b>	
					<b>Factor,</b>	
					<b>n = 3, I = 5%</b>	<b>Present Value</b>
			<b><u>\$ 5,400</u></b>		<b>0.86384</b>	<b><u>\$ 4,664.74</u></b>
					<b>Total Estimated Liability</b>	<b><u>\$ 12,320.06</u></b>

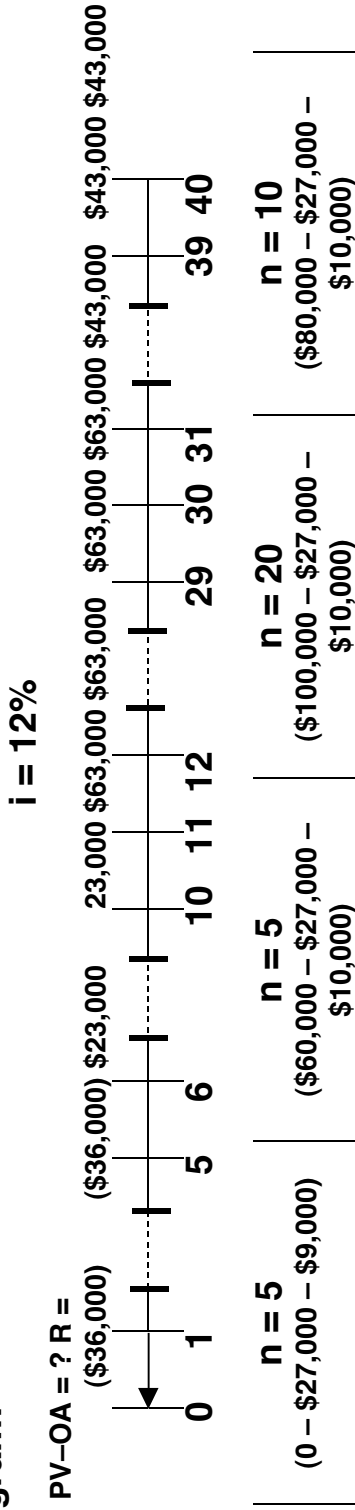
**PROBLEM 6-7**

Cash Flow	Probability				
Estimate X	Assessment =	Expected Cash Flow			
2004	\$ 6,000	40%	\$ 2,400		
	8,000	60%	<u>4,800</u>	X PV	
				Factor,	
				n = 1, I = 6%	Present Value
			<u>\$ 7,200</u>	0.9434	<u>\$ 6,792.48</u>
2005	\$ (500)	20%	\$ (100)		
	2,000	60%	1,200		
	3,000	20%	<u>600</u>	X PV	
				Factor,	
				n = 2, I = 6%	Present Value
			<u>\$ 1,700</u>	0.89	<u>\$ 1,513.00</u>
Scrap Value Received at the End of 2005	\$ 500	50%	\$ 250		
	700	50%	<u>350</u>	X PV	
				Factor,	
				n = 2, I = 6%	Present Value
			<u>\$ 600</u>	0.89	<u>\$ 534.00</u>
			<b>Estimated Fair Value</b>		<b><u>\$ 8,839.48</u></b>



**PROBLEM 6-8**

**Time diagram:**



**Formulas:**

$PV-OA = R (PVF-OA_{n,i})$	$PV-OA = R (PVF-OA_{n,i})$	$PV-OA = R (PVF-OA_{n,i})$
$PV-OA = (\$36,000)(PVF-OA_{5,12\%})$	$PV-OA = \$23,000 (PVF-OA_{10-5, 12\%})$	$PV-OA = \$63,000 (PVF-OA_{30-10, 12\%})$
$PV-OA = (\$36,000)(3.60478)$	$PV-OA = \$23,000 (5.65022 - 3.60478)$	$PV - OA = \$63,000 (8.05518 - 5.65022)$
$PV-OA = (\$129,772.08)$	$PV-OA = \$23,000 (2.04544)$	$PV - OA = \$43,000 (8.24378 - 8.05518)$
	$PV-OA = \$47,045.12$	$PV-OA = \$43,000 (.18860)$
		$PV-OA = \$8,109.80$

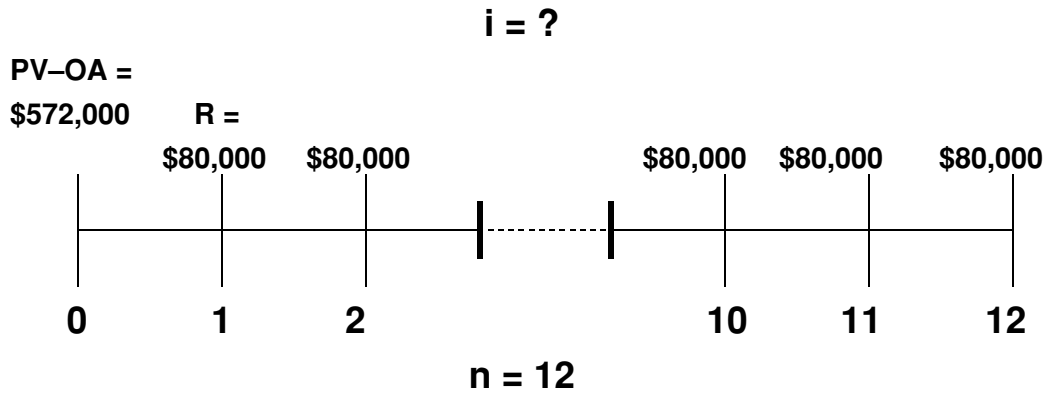
**Present value of future net cash inflows:**

\$(129,772.08)
47,045.12
151,512.48
8,109.80
<u>\$ 76,895.32</u>

Nicole Bobek should accept no less than \$76,895.32 for her vineyard business.

**PROBLEM 6-9**

(a) Time diagram (alternative one):



Formulas:  $PV-OA = R (PVF-OA_{n,i})$

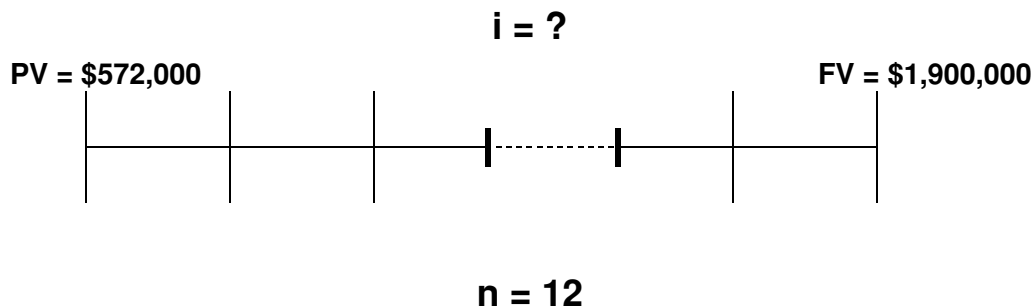
$$\$572,000 = \$80,000 (PVF-OA_{12,i})$$

$$PVF-OA_{12,i} = \$572,000 \div \$80,000$$

$$PVF-OA_{12,i} = \underline{7.15}$$

7.15 is present value of an annuity of \$1 for 12 years discounted at approximately 9%.

Time diagram (alternative two):





**PROBLEM 6-9 (Continued)**

**Formulas:  $PV-OA = R (PVF-OA_{n, i})$**

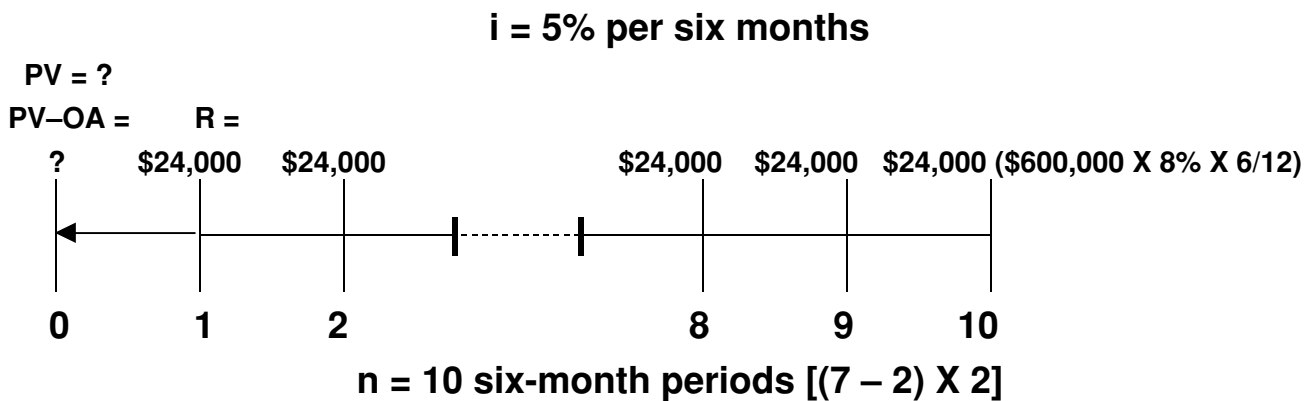
**$\$624,150 = \$76,952 (PVF-OA_{10, i})$**

**$PV-OA_{10, i} = \$624,150 \div \$76,952$**

**$PV-OA_{10, i} = \underline{8.11090}$**

**8.11090 is the present value of a 10-period annuity of \$1 discounted at 4%. The interest rate is 4% semiannually, or 8% annually.**

**(c) Time diagram:**



**Formulas:**

**$PV-OA = R (PVF-OA_{n, i})$**

**$PV = FV (PVF_{n, i})$**

**$PV-OA = \$24,000 (PVF-OA_{10, 5\%})$**

**$PV = \$600,000 (PVF_{10, 5\%})$**

**$PV-OA = \$24,000 (7.72173)$**

**$PV = \$600,000 (.61391)$**

**$PV-OA = \underline{\$185,321.52}$**

**$PV = \underline{\$368,346}$**

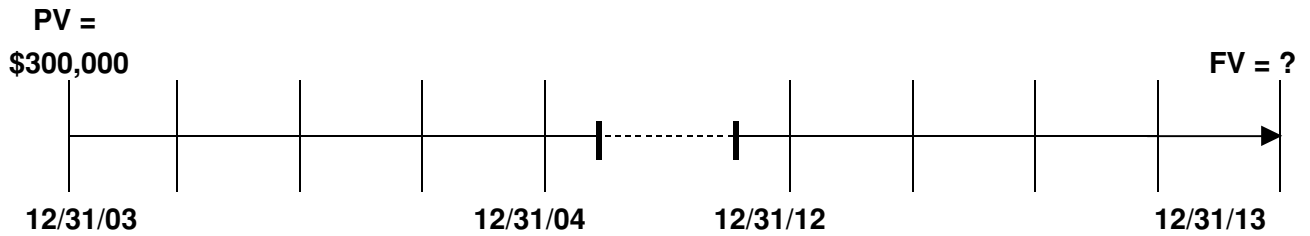
**Combined present value (amount received on sale of note):**

**$\$185,321.52 + \$368,346 = \underline{\$553,667.52}$**

**PROBLEM 6-9 (Continued)**

**(d) Time diagram (future value of \$300,000 deposit)**

**$i = 2\frac{1}{2}\%$  per quarter**



**$n = 40$  quarters**

**Formula:  $FV = PV (FVF_{n,i})$**

$$FV = \$300,000 (FVF_{40, 2\frac{1}{2}\%})$$

$$FV = \$300,000 (2.68506)$$

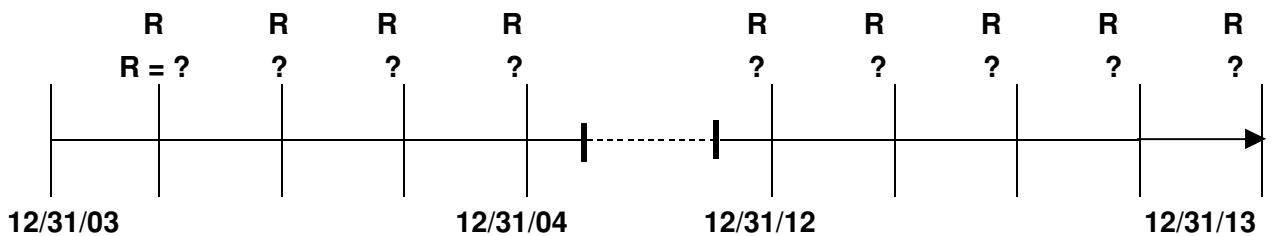
$$FV = \underline{\underline{\$805,518}}$$

**Amount to which quarterly deposits must grow:**

$$\$1,300,000 - \$805,518 = \underline{\underline{\$494,482.}}$$

**Time diagram (future value of quarterly deposits)**

**$i = 2\frac{1}{2}\%$  per quarter**



**$n = 40$  quarters**

## PROBLEM 6-9 (Continued)

Formulas:  $FV-OA = R (FVF-OA_{n,i})$

$$\$494,482 = R (FVF-OA_{40, 2\ 1/2\%i})$$

$$\$494,482 = R (67.40255)$$

$$R = \$494,482 \div 67.40255$$

$$R = \underline{\underline{\$7,336.25}}$$

<b>PROBLEM 6-10</b>
---------------------

Vendor A:            \$15,000 payment  
                   X 6.14457 (PV of ordinary annuity 10%, 10 periods)  
                   \$ 92,168.55  
                   + 45,000.00 down payment  
                   + 10,000.00 maintenance contract  
                   \$147,168.55 total cost from Vendor A

Vendor B:            \$8,000 semiannual payment  
                   18.01704 (PV of annuity due 5%, 40 periods)  
                   \$144,136.32

Vendor C:            \$1,000  
                   X 3.79079 (PV of ordinary annuity of 5 periods, 10%)  
                   \$ 3,790.79 PV of first 5 years of maintenance  
  
                   \$2,000 [PV of ordinary annuity 15 per., 10% (7.60608) –  
                   X 3.81529        PV of ordinary annuity 5 per., 10% (3.79079)]  
                   \$ 7,630.58 PV of next 10 years of maintenance  
  
                   \$3,000 [(PV of ordinary annuity 20 per., 10% (8.51356) –  
                   X .90748        PV of ordinary annuity 15 per., 10% (7.60608)]  
                   \$ 2,722.44 PV of last 5 years of maintenance

**Total cost of press and maintenance Vendor C:**  
                   \$125,000.00 cash purchase price  
                   3,790.79 maintenance years 1-5  
                   7,630.58 maintenance years 6-15  
                   2,722.44 maintenance years 16-20  
                   \$139,143.81

The press should be purchased from Vendor C, since the present value of the cash outflows for this option is the lowest of the three options.

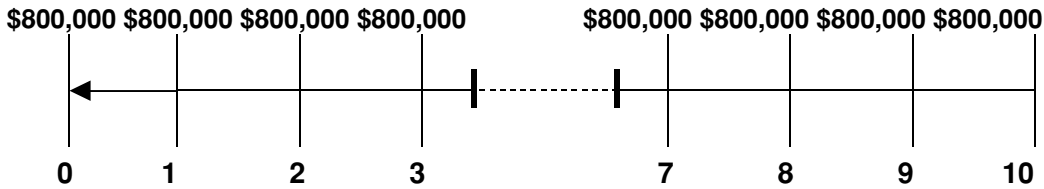
**PROBLEM 6-11**

(a) Time diagram for the first ten payments:

$i = 10\%$

PV-AD = ?

R =



$n = 10$

Formula for the first ten payments:

$$PV-AD = R (PVF-AD_{n,i})$$

$$PV-AD = \$800,000 (PVF-AD_{10,10\%})$$

$$PV-AD = \$800,000 (6.75902)$$

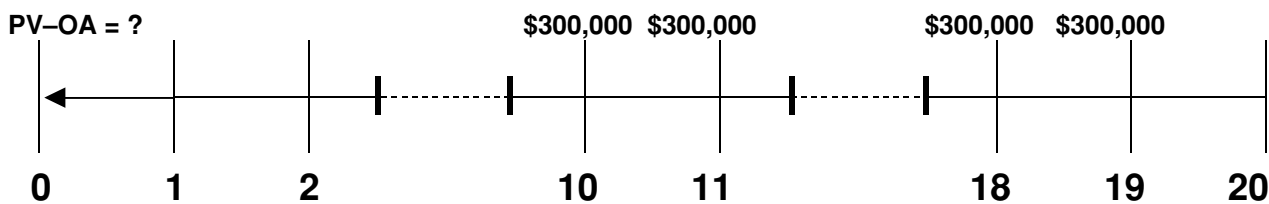
$$PV-OA = \$5,407,216$$

Time diagram for the last ten payments:

$i = 10\%$

PV-OA = ?

R =



$n = 9$

$n = 10$



## PROBLEM 6-11 (Continued)

Formula for the last ten payments:

$$PV-OA = R (PVF-OA_{n,i})$$

$$PV-OA = \$300,000 (PVF-OA_{19-9, 10\%})$$

$$PV-OA = \$300,000 (8.36492 - 5.75902)$$

$$PV-OA = \$300,000 (2.6059)$$

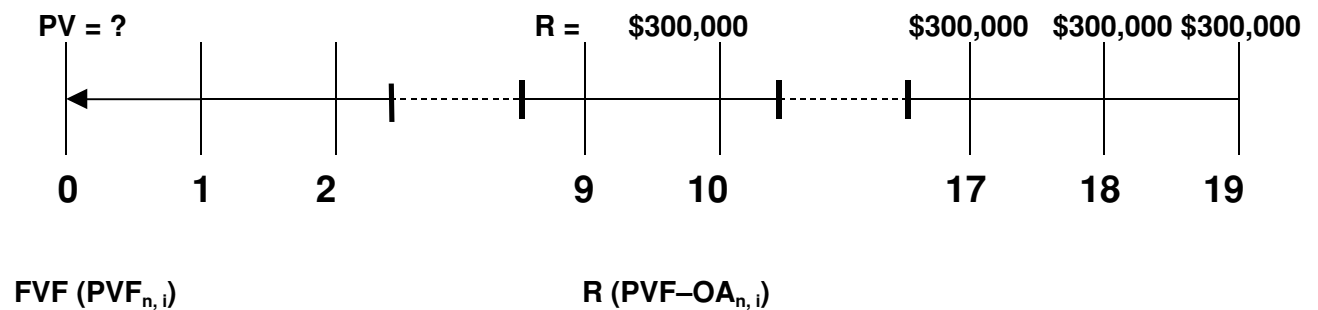
$$PV-OA = \underline{\underline{\$781,770}}$$

Note: The present value of an ordinary annuity is used here, not the present value of an annuity due.

OR

Time diagram for the last ten payments:

$i = 10\%$



## PROBLEM 6-11 (Continued)

Formulas for the last ten payments:

(i) Present value of the last ten payments:

$$PV-OA = R (PVF-OA_{n, i})$$

$$PV-OA = \$300,000 (PVF-OA_{10, 10\%})$$

$$PV-OA = \$300,000 (6.14457)$$

$$PV-OA = \underline{\$1,843,371}$$

(ii) Present value of the last ten payments at the beginning of current year:

$$PV = FV (PVF_{n, i})$$

$$PV = \$1,843,371 (PVF_{9, 10\%})$$

$$PV = \$1,843,371 (.42410)$$

$$PV = \underline{\$781,774^*}$$

\*\$4 difference due to rounding.

$$\text{Cost for leasing the facilities} \quad \$5,407,216 + \$781,774 = \underline{\$6,188,990}$$

Since the present value of the cost for leasing the facilities, \$6,188,990, is less than the cost for purchasing the facilities, \$7,200,000, Starship Enterprises should lease the facilities.

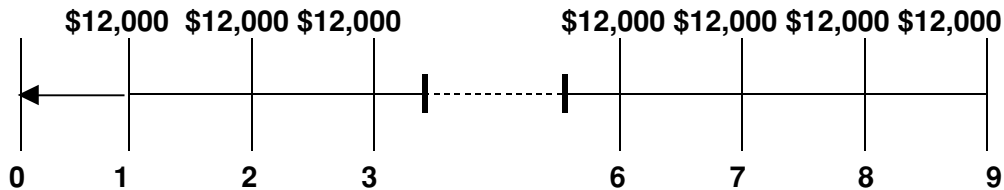
**PROBLEM 6-11 (Continued)**

**(b) Time diagram:**

$$i = 11\%$$

PV-OA = ?

R =



$$n = 9$$

**Formula:**  $PV-OA = R (PVF-OA_{n,i})$

$$PV-OA = \$12,000 (PVF-OA_{9,11\%})$$

$$PV-OA = \$12,000 (5.53705)$$

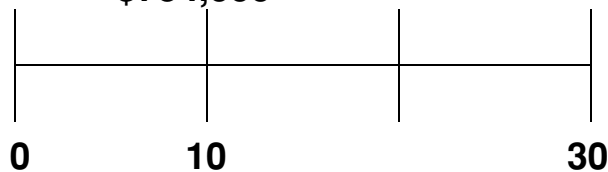
$$PV-OA = \underline{\underline{\$66,444.60}}$$

The fair value of the note is \$66,444.60.

**(c) Time diagram:**

**Amount paid =**

**\$784,000**



**Amount paid =**

**\$800,000**

## PROBLEM 6-11 (Continued)

$$\text{Cash discount} = \$800,000 (2\%) = \$16,000$$

$$\text{Net payment} = \$800,000 - \$16,000 = \$784,000$$

If the company decides not to take the cash discount, then the company can use the \$784,000 for an additional 20 days. The implied interest rate for postponing the payment can be calculated as follows:

- (i) Implied interest for the period from the end of discount period to the due date:

$$\frac{\text{Cash discount lost if not paid within the discount period}}{\text{Net payment being postponed}}$$

$$= \$16,000/\$784,000$$

$$= 0.0204$$

- (ii) Convert the implied interest rate to annual basis:

$$\text{Daily interest} = 0.0204/20 = 0.00102$$

$$\text{Annual interest} = 0.00102 \times 365 = 37.23\%$$

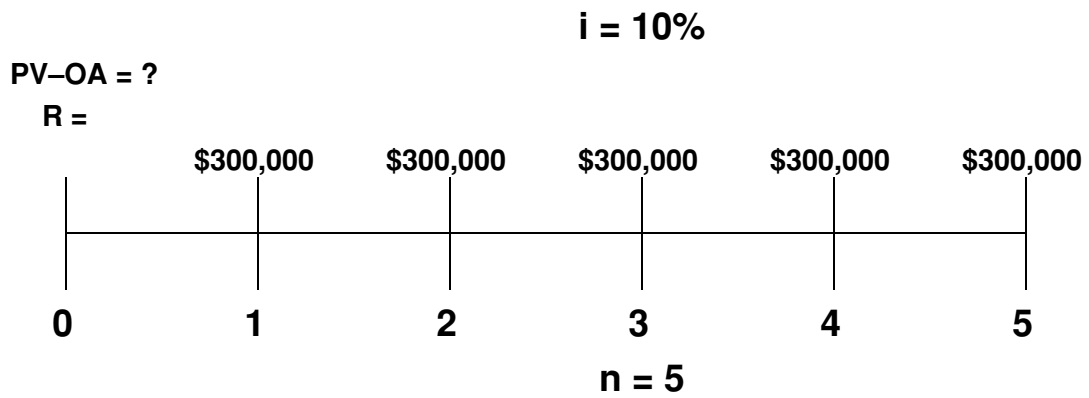
Since Starship's cost of funds, 10%, is less than the implied interest rate for cash discount, 37.23%, it should continue the policy of taking the cash discount.

**PROBLEM 6-12**

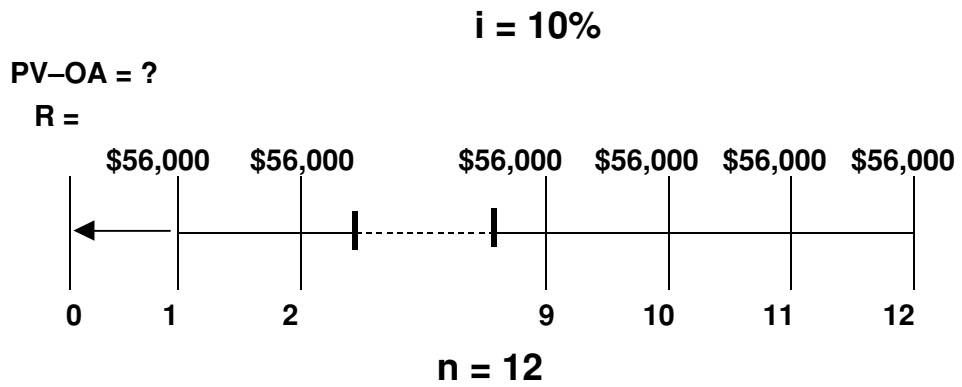
**1. Purchase.**

**Time diagrams:**

**Installments**

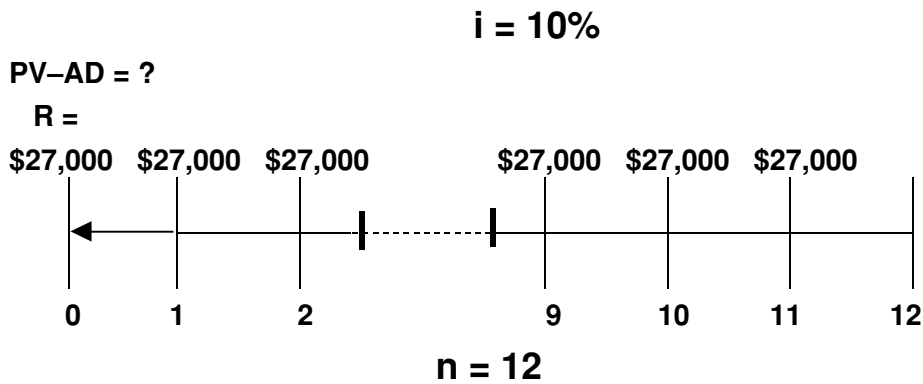


**Property taxes and other costs**

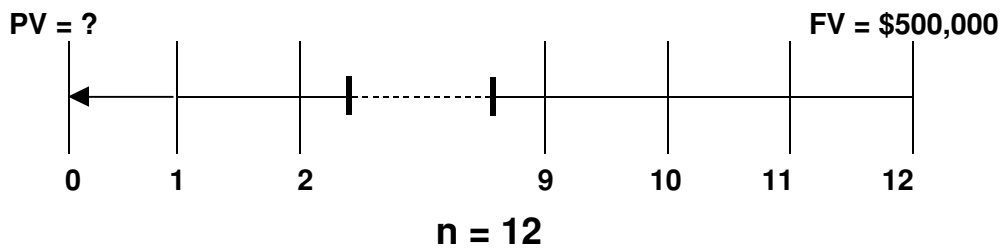


## PROBLEM 6-12 (Continued)

### Insurance



### Salvage Value



Formula for installments:

$$PV-OA = R (PVF-OA_{n, i})$$

$$PV-OA = \$300,000 (PVF-OA_{5, 10\%})$$

$$PV-OA = \$300,000 (3.79079)$$

$$PV-OA = \underline{\underline{\$1,137,237}}$$

## PROBLEM 6-12 (Continued)

Formula for property taxes and other costs:

$$PV-OA = R (PVF-OA_{n, i})$$

$$PV-OA = \$56,000 (PVF-OA_{12, 10\%})$$

$$PV-OA = \$56,000 (6.81369)$$

$$PV-OA = \underline{\$381,567}$$

Formula for insurance:

$$PV-AD = R (PVF-AD_{n, i})$$

$$PV-AD = \$27,000 (PVF-AD_{12, 10\%})$$

$$PV-AD = \$27,000 (7.49506)$$

$$PV-AD = \underline{\$202,367}$$

Formula for salvage value:

$$PV = FV (PVF_{n, i})$$

$$PV = \$500,000 (PVF_{12, 10\%})$$

$$PV = \$500,000 (0.31863)$$

$$PV = \underline{\$159,315}$$

**PROBLEM 6-12 (Continued)**

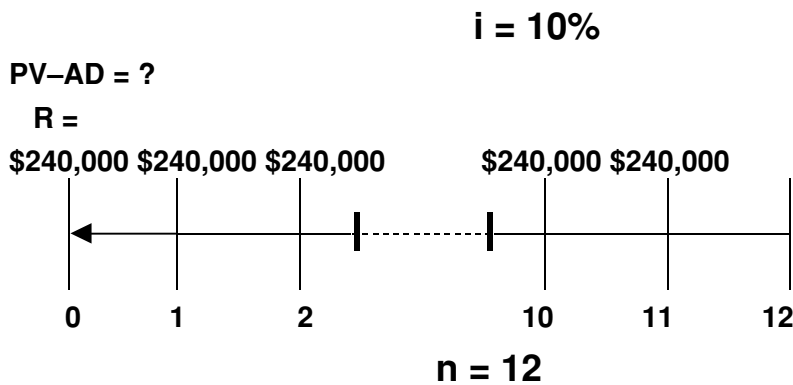
**Present value of net purchase costs:**

<b>Down payment</b>	<b>\$ 400,000</b>
<b>Installments</b>	<b>1,137,237</b>
<b>Property taxes and other costs</b>	<b>381,567</b>
<b>Insurance</b>	<b><u>202,367</u></b>
<b>Total costs</b>	<b>\$2,121,171</b>
<b>Less: Salvage value</b>	<b><u>159,315</u></b>
<b>Net costs</b>	<b><u>\$1,961,856</u></b>

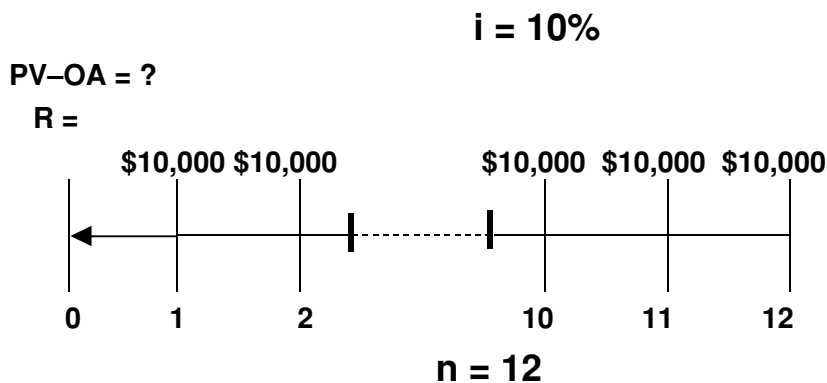
**2. Lease.**

**Time diagrams:**

**Lease payments**



**Interest lost on the deposit**





## PROBLEM 6-12 (Continued)

Formula for lease payments:

$$PV-AD = R (PVF-AD_{n, i})$$

$$PV-AD = \$240,000 (PVF-AD_{12, 10\%})$$

$$PV-AD = \$240,000 (7.49506)$$

$$PV-AD = \underline{\$1,798,814}$$

Formula for interest lost on the deposit:

Interest lost on the deposit per year = \$100,000 (10%) = \$10,000

$$PV-OA = R (PVF-OA_{n, i})$$

$$PV-OA = \$10,000 (PVF-OA_{12, 10\%})$$

$$PV-OA = \$10,000 (6.81369)$$

$$PV-OA = \underline{\$68,137^*}$$

Cost for leasing the facilities = \$1,798,814 + \$68,137 = \$1,866,951

Rijo Inc. should lease the facilities because the present value of the costs for leasing the facilities, \$1,866,951, is less than the present value of the costs for purchasing the facilities, \$1,961,856.

\*OR: \$100,000 - (\$100,000 X .31863) = \$68,137

**PROBLEM 6-13**

**(a) Annual retirement benefits.**

**Maugarite—current salary \$ 40,000.00**  
**X 2.56330 (future value of 1, 24 periods, 4%)**  
**102,532.00 annual salary during last year of**  
**work**  
**X .50 retirement benefit %**  
**\$ 51,266.00 annual retirement benefit**

**Kenny—current salary \$30,000.00**  
**X 3.11865 (future value of 1, 29 periods, 4%)**  
**93,559.50 annual salary during last year of**  
**work**  
**X .40 retirement benefit %**  
**\$37,424.00 annual retirement benefit**

**Anita—current salary \$15,000.00**  
**X 2.10685 (future value of 1, 19 periods, 4%)**  
**31,602.75 annual salary during last year of**  
**work**  
**X .40 retirement benefit %**  
**\$12,641.00 annual retirement benefit**

**Willie—current salary \$15,000.00**  
**X 1.73168 (future value of 1, 14 periods, 4%)**  
**25,975.20 annual salary during last year of**  
**work**  
**X .40 retirement benefit %**  
**\$10,390.00 annual retirement benefit**

**PROBLEM 6-13 (Continued)**

**(b) Fund requirements after 15 years of deposits at 12%.**

**Maugarite will retire 10 years after deposits stop.**

<b>\$ 51,266.00</b>	<b>annual plan benefit</b>
	<b>[PV of an annuity due for 30 periods – PV of an</b>
<b>X <u>2.69356</u></b>	<b>annuity due for 10 periods (9.02181 – 6.32825)]</b>
<b><u>\$138,088.00</u></b>	

**Kenny will retire 15 years after deposits stop.**

<b>\$37,424.00</b>	<b>annual plan benefit</b>
<b>X <u>1.52839</u></b>	<b>[PV of an annuity due for 35 periods – PV of an</b>
	<b>annuity due for 15 periods (9.15656 – 7.62817)]</b>
<b><u>\$57,198.00</u></b>	

**Anita will retire 5 years after deposits stop.**

<b>\$12,641.00</b>	<b>annual plan benefit</b>
<b>X <u>4.74697</u></b>	<b>[PV of an annuity due for 25 periods – PV of an</b>
	<b>annuity due for 5 periods (8.78432 – 4.03735)]</b>
<b><u>\$60,006.00</u></b>	

**Willie will retire the beginning of the year after deposits stop.**

<b>\$10,390.00</b>	<b>annual plan benefit</b>
<b>X <u>8.36578</u></b>	<b>(PV of an annuity due for 20 periods)</b>
<b><u>\$86,920.00</u></b>	

**PROBLEM 6-13 (Continued)**

**\$138,088.00 Maugarite**

**57,198.00 Kenny**

**60,006.00 Anita**

**86,920.00 Willie**

**\$342,212.00 Required fund balance at the end of the 15 years of deposits.**

**(c) Required annual beginning-of-the-year deposits at 12%:**

**Deposit X (future value of an annuity due for 15 periods at 12%) = FV**

**Deposit X (37.27972 X 1.12) = \$342,212.00**

**Deposit = \$342,212.00 ÷ 41.75329**

**Deposit = \$8,196.00.**

**PROBLEM 6-14**

- (a) The time value of money would suggest that NET Life's discount rate was substantially higher than First Security's. The actuaries at NET Life are making different assumptions about inflation, employee turnover, life expectancy of the work force, future salary and wage levels, return on pension fund assets, etc. NET Life may operate at lower gross and net margins and it may provide fewer services.
- (b) As the controller of KBS, Qualls assumes a fiduciary responsibility to the present and future retirees of the corporation. As a result, he is responsible for ensuring that the pension assets are adequately funded and are adequately protected from most controllable risks. At the same time, Qualls is responsible for the financial condition of KBS. In other words, he is obligated to find ethical ways of increasing the profits of KBS, even if it means switching pension funds to a less costly plan. At times, Qualls' role to retirees and his role to the corporation can be in conflict, especially if Qualls is a member of a professional group such as CPAs or CMAs.
- (c) If KBS switched to NET Life

The primary beneficiaries of Qualls' decision would be the corporation and its many stockholders by virtue of reducing 8 million dollars of annual pension costs.

The present and future retirees of KBS may be negatively affected by Qualls' decision because the change of losing a future benefit may be increased by virtue of higher risks (as reflected in the discount rate and NET Life's weaker reputation).

If KBS stayed with First Security

In the short run, the primary beneficiaries of Qualls' decision would be the employees and retirees of KBS given the lower risk pension asset plan.

KBS and its many stakeholders could be negatively affected by Qualls' decision to stay with First Security because of the company's inability to trim 8 million dollars from its operating expenses.

**\*PROBLEM 6-15**

(a)

<b>Inputs:</b>	<b>8</b>	<b>7.25</b>	<b>0</b>	<b>?</b>	<b>70,000</b>
	<b>N</b>	<b>I</b>	<b>PV</b>	<b>PMT</b>	<b>FV</b>

**Answer:** **-6,761.57**

(b)

**Note—set to begin mode.**

<b>Inputs:</b>	<b>25</b>	<b>9.65</b>	<b>0</b>	<b>?</b>	<b>500,000</b>
	<b>N</b>	<b>I</b>	<b>PV</b>	<b>PMT</b>	<b>FV</b>

**Answer:** **-4,886.59**

(c)

<b>Inputs:</b>	<b>4</b>	<b>?</b>	<b>-17,000</b>	<b>0</b>	<b>26,000</b>
	<b>N</b>	<b>I</b>	<b>PV</b>	<b>PMT</b>	<b>FV</b>

**Answer:** **11.21**

**\*PROBLEM 6-16**

(a)

<b>Inputs:</b>	<b>15</b>	<b>?</b>	<b>-150,000</b>	<b>20,000</b>	<b>0</b>
	<b>N</b>	<b>I</b>	<b>PV</b>	<b>PMT</b>	<b>FV</b>

**Answer:** 10.25

(b)

<b>Inputs:</b>	<b>7</b>	<b>7.35</b>	<b>?</b>	<b>-16,000</b>	<b>0</b>
	<b>N</b>	<b>I</b>	<b>PV</b>	<b>PMT</b>	<b>FV</b>

**Answer:** 85,186.34

(c)

<b>Inputs:</b>	<b>10</b>	<b>10.65</b>	<b>?</b>	<b>16,000</b>	<b>200,000</b>
	<b>N</b>	<b>I</b>	<b>PV</b>	<b>PMT</b>	<b>FV</b>

**Answer:** -168,323.64

**\*PROBLEM 6-17**

(a)

<b>Inputs:</b>	<b>20</b>	<b>5.25</b>	<b>-180,000</b>	<b>?</b>	<b>0</b>
	<input type="text" value="N"/>	<input type="text" value="I"/>	<input type="text" value="PV"/>	<input type="text" value="PMT"/>	<input type="text" value="FV"/>
<b>Answer:</b>				<b>-14,751.41</b>	

(b)

**Note—set payments at 12 per year.**

<b>Inputs:</b>	<b>96</b>	<b>9.1</b>	<b>35,000</b>	<b>?</b>	<b>0</b>
	<input type="text" value="N"/>	<input type="text" value="I"/>	<input type="text" value="PV"/>	<input type="text" value="PMT"/>	<input type="text" value="FV"/>
<b>Answer:</b>				<b>-514.57</b>	

(c)

**Note—set to begin mode.**

<b>Inputs:</b>	<b>5</b>	<b>8.25</b>	<b>8,000</b>	<b>?</b>	<b>0</b>
	<input type="text" value="N"/>	<input type="text" value="I"/>	<input type="text" value="PV"/>	<input type="text" value="PMT"/>	<input type="text" value="FV"/>
<b>Answer:</b>				<b>-1,863.16</b>	

(d)

**Note—set back to end mode.**

<b>Inputs:</b>	<b>5</b>	<b>8.25</b>	<b>8,000</b>	<b>?</b>	<b>0</b>
	<input type="text" value="N"/>	<input type="text" value="I"/>	<input type="text" value="PV"/>	<input type="text" value="PMT"/>	<input type="text" value="FV"/>
<b>Answer:</b>				<b>-2,016.87</b>	



## FINANCIAL REPORTING PROBLEM

**(a) 1. Property, plant, and equipment**

Property, plant and equipment are recorded at cost, including capitalized interest and internal engineering cost.

For Impairment of long-lived assets, fair value is determined using a discounted cash flow analysis.

**2. Long-term and short-term debt**

**3. Pension and Postretirement Benefit Plans**

**4. Employee Savings and Stock Ownership Plans**

**(b) 1. The following rates are disclosed in the accompanying notes:**

**Debt**

**Weighted-Average Effective Interest Rate**

	Total		Excluding ESOP debt	
	2001	2000	2001	2000
At December 31				
Short-Term	3.98%	6.29%	3.94%	6.30%
Long-Term	3.60%	4.84%	3.15%	4.48%

## FINANCIAL REPORTING PROBLEM (Continued)

### Benefit Plans

(Millions)	Pension Benefits				Postretirement	
	United States		Interntl.		Benefits	
	2001	2000	2001	2000	2001	2000
Weighted average assumptions						
Discount rate	7.25%	7.50%	5.23%	5.40%	7.25%	7.50%
Expected return on assets	9.00%	9.00%	7.42%	7.14%	9.50%	8.19%

### Employee Savings and Stock Ownership Plans

MSOP Assumptions	Annual		Progressive (Reload)	
	2001	2000	2001	2000
Risk-free interest rate	4.8%	6.7%	3.8%	6.3%

2. There are so many different rates for various reasons:
  1. The maturity dates—short-term vs. long-term.
  2. The security or lack of security for debts—mortgages and collateral vs. unsecured loans.
  3. Fixed rates and variable rates.
  4. Issuances of securities at different dates when differing market rates were in effect.
  5. Different risks involved or assumed.
  6. Foreign currency differences—some investments and payables are denominated in different currencies.

## FINANCIAL STATEMENT ANALYSIS CASE

- (a) Cash inflows (\$350,000) less cash outflows (\$125,000) = Net cash flows (\$225,000)

$$\$225,000 \times 2.48685 \text{ (PVF-OA}_{3, 10\%}) = \underline{\$559,541.25}$$

- (b) Cash inflows (\$275,000) less cash outflows (\$175,000) = Net cash flows (\$100,000)

$$\$100,000 \times 2.48685 \text{ (PVF-OA}_{3, 10\%}) = \underline{\$248,685}$$

- (c) The estimate of future cash flows is very useful. It provides an understanding of whether the value of gas and oil properties is increasing or decreasing from year to year. Although it is an estimate, it does provide an understanding of the direction of change in value. Also, it can provide useful information to record a write-down of the assets.

## RESEARCH CASE 1

- (a) The Form 10-K items include: (1) Business, (2) Properties, (3) Legal Proceedings, (4) Submission of Matters to a Vote of Security Holders, (5) Market for Registrant’s Common Equity and Related Stockholder Matters, (6) Selected Financial Data, (7) Management’s Discussion and Analysis of Financial Condition and Results of Operations, (8) Financial Statements and Supplemental Data, (9) Changes in and Disagreements with Accountants on Accounting and Financial Disclosure, (10) Directors and Executive Officers of the Registrant, (11) Executive Compensation, (12) Security Ownership of Certain Beneficial Owners and Management, (13) Certain Relationships and Related Transactions, and (14) Exhibits, Financial Statement Schedules, and Reports on Form 8-K.**
- (b) If financials are not included, they have been “incorporated by reference” from the annual report to shareholders.**
- (c) Depends on firm selected.**

## RESEARCH CASE 2

(a) FASB pronouncements usually provoke some controversy, and Concepts Statements are no exception. The principle objections raised in recent Exposure Drafts are largely the same objections raised when the Board was deliberating Concepts Statement 7. They focus on three areas:

1. Use of the *expected-cash-flow approach* in developing present value measurements
2. Use of *fair value* as the objective for measurements on initial recognition and subsequent fresh-start measurements that employ present value.
3. Inclusion of the *entity's credit standing* in the measurement of its liabilities.

(b) Prior to Concepts Statement 7, many accounting pronouncements used the term *best estimate* to describe the target for estimated cash flows. The term was never defined, but its contexts seem to suggest that an accounting *best estimate* is:

1. Unbiased
2. In a range of possible outcomes, the most likely amount
3. A single amount or point estimate.

## RESEARCH CASE 2 (Continued)

Few other professions follow the accounting practice of equating *best estimate* and *most likely*. Statisticians, actuaries, scientists and engineers tend to avoid the term *best estimate*. When they use it, they do so to describe the expected value—the probability-weighted average. But accountants have grown used to the *most-likely* meaning for best estimate.

The Board has long recognized that present values can be changed by altering either cash flows or discount rates. Still, the Board’s early deliberations took the traditional path of developing a best estimate of cash flows and then selecting an appropriate interest rate. Over time, the Board found that a focus on finding the “right” interest rate was unproductive. Any positive interest rate would make the discounted number smaller than the undiscounted best estimate, but there had to be more to present value than that. Moreover, it became clear that intuitions built on contractual cash flows and interest rates don’t always work when applied to assets and liabilities that don’t have contractual amounts and payment dates.

Moving the reference point from contractual to estimated cash flows disrupts the conventional relationships that apply to contractual cash flows. What is the “rate commensurate with the risk” when actual cash flows may be higher or lower than the best estimate? Is the rate higher or lower than risk free? By how much? Does the answer change if the item is a liability rather than an asset? What are the proper cash flows and interest rate when *timing* is uncertain? The traditional approach doesn’t provide ready answers to those questions. In a sense, the drafters of Opinion 21 had it right. *If* a single best-estimate of future cash flows and a single interest rate are the only tools for computing present value, then the technique cannot reasonably be applied to a broader range of measurement problems.

## RESEARCH CASE 2 (Continued)

- (c) **The Board was looking at two sets of principles: the elements of economic value and the practical principles of present value.**

**The elements of economic value (paragraphs 23 and 39) are:**

- a. **An estimate of the future cash flow, or in more complex cases, series of future cash flows at different times**
- b. **Expectations about possible variations in the amount or timing of those cash flows**
- c. **The time value of money, represented by the risk-free rate of interest**
- d. **The price for bearing the uncertainty inherent in the asset or liability**
- e. **Other, sometimes unidentifiable, factors including illiquidity and market imperfections.**

**The practical principles, stated simply, are:**

- a. **Don't leave anything out. (But see item e.)**
  - b. **Use consistent assumptions and don't count the same thing twice.**
  - c. **Keep your finger off the scale.**
  - d. **Aim for the average of a range, rather than a single most-likely, minimum or maximum amount.**
  - e. **Don't make up what you don't know.**
- (d) **Most accounting estimates use nominal amounts; the estimate includes the effect of inflation. The focus here is on Practical Principle (b)—Use consistent assumptions. If the estimated cash flows do not include inflation, if instead they are real amounts, then the discount rate should not include inflation. Nominal cash flows are discounted at a nominal rate, and real cash flows at a real rate.**





# PROFESSIONAL SIMULATION (Continued)

(b)

	A	B	C	D	E	F	G
1							
2	<b>Bond Amortization Schedule</b>						
3							
4	Date	Cash Interest	Interest Expense	Bond Discount Amortization	Carrying Value of Bonds		
5	Year 0				\$92,790.45		
6	Year 1	10,000.00	\$11,134.85	\$1,134.85	93,925.30		
7	Year 2	10,000.00	11,271.04	1,271.04	95,196.34		
8	Year 3	10,000.00	11,423.56	1,423.56	96,619.90		
9	Year 4	10,000.00	11,594.39	1,594.39	98,214.29		
10	Year 5	10,000.00	11,785.71	1,785.71	100,000.00		
11							
12							
13							
14							
15							

The following formula is entered in the cells in this column: =+C6-B6.

The following formula is entered in the cells in this column: =+E5+D6

The following formula is entered in the cells in this column: =+E5\*0.12.

