CHAPTER 6

Accounting and the Time Value of Money

ASSIGNMENT CLASSIFICATION TABLE (BY TOPIC)

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

ASSIGNMENT CLASSIFICATION TABLE (BY LEARNING OBJECTIVE)

Learning Objectives	Brief Exercises	Exercises	Problems
1. Identify accounting topics where the time value of money is relevant.			
2. Distinguish between simple and compound interest.		2	
3. Use appropriate compound interest tables.		1	
4. Identify variables fundamental to solving interest problems.			
5. Solve future and present value of 1 problems.	1, 2, 3, 4, 7, 8	2, 3, 6, 9, 10, 15	1, 2, 3, 5, 7, 9, 10
6. Solve future value of ordinary and annuity due problems.	5, 6, 9, 13	3, 4, 5, 6, 15, 16	2, 7, 10
7. Solve present value of ordinary and annuity due problems.	10, 11, 12, 14, 16, 17	3, 4, 5, 6, 11, 12, 17, 18, 19	1, 3, 4, 5, 7, 8, 9, 10, 13, 14
8. Solve present value problems related to deferred annuities and bonds.	15	5, 7, 8, 13, 14	6, 11, 12
9. Apply expected cash flows to present value measurement.		20, 21, 22	13, 14, 15

ASSIGNMENT CHARACTERISTICS TABLE

Item	Description	Level of Difficulty	Time (minutes)
E6-1	Using interest tables.	Simple	5–10
E6-2	Simple and compound interest computations.	Simple	5–10
E6-3	Computation of future values and present values.	Simple	10–15
E6-4	Computation of future values and present values.	Moderate	15–20
E6-5	Computation of present value.	Simple	10–15
E6-6	Future value and present value problems.	Moderate	15–20
E6-7	Computation of bond prices.	Moderate	12–17
E6-8	Computations for a retirement fund.	Simple	10–15
E6-9	Unknown rate.	Moderate	5–10
E6-10	Unknown periods and unknown interest rate.	Simple	10–15
E6-11	Evaluation of purchase options.	Moderate	10–15
E6-12	Analysis of alternatives.	Simple	10–15
E6-13	Computation of bond liability.	Moderate	15–20
E6-14	Computation of pension liability.	Moderate	15–20
E6-15	Investment decision.	Moderate	15–20
E6-16	Retirement of debt.	Simple	10–15
E6-17	Computation of amount of rentals.	Simple	10–15
E6-18	Least costly payoff.	Simple	10–15
E6-19	Least costly payoff.	Simple	10–15
E6-20	Expected cash flows.	Simple	5–10
E6-21	Expected cash flows and present value.	Moderate	15–20
E6-22	Fair value estimate.	Moderate	15–20
P6-1	Various time value situations.	Moderate	15–20
P6-2	Various time value situations.	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	Purchase price of a business.	Moderate	25–30
P6-7	Time value concepts applied to solve business problems.	Complex	30–35
P6-8	Analysis of alternatives.	Moderate	20–30
P6-9	Analysis of business problems.	Complex	30–35
P6-10	Analysis of lease vs. purchase.	Complex	30–35
P6-11	Pension funding.	Complex	25–30
P6-12	Pension funding.	Moderate	20–25
P6-13	Expected cash flows and present value.	Moderate	20–25
P6-14	Expected cash flows and present value.	Moderate	20–25
P6-15	Fair value estimate.	Complex	20–25

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, (8) amortization of premiums and discounts, and (9) estimation of fair value.

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 bonds 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:
(a) 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.
(b) 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.
(c) 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.

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).

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. This is shown in the following calculation:

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

n = 4
R$1,500 X 1.16986 = R$1,754.79
i = 4

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

n = 8
R$1,500 X 1.17166 = R$1,757.49
i = 2

Thus, with quarterly compounding, Jose could earn R$2.70 more.

7. $26,897.80 = $20,000 X 1.34489 (future value of 1 at $2^1/_2$ for 12 periods).

8. $44,671.20 = $80,000 X .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 each of the intervals for annuities due.

10. Amount paid each year = $\frac{€40{,}000}{3.03735}$ (present value of an ordinary annuity at 12% for 4 years).

Amount paid each year = €13,169.37.

11. Amount deposited each year = $\frac{¥20{,}000{,}000}{4.64100}$ (future value of an ordinary annuity at 10% for 4 years).

Amount deposited each year = ¥4,309,416.

12. Amount deposited each year = $\frac{¥20{,}000{,}000}{5.10510}$ [future value of an annuity due at 10% for 4 years (4.64100 X 1.10)].

Amount deposited each year = ¥3,917,651.

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.

\$245,000 = 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 = $\frac{\$245{,}000}{\$25{,}000} = 9.8.$

The factor 9.8 is closest to 9.81815 in the 8% 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 X £20,000 = £51,316.20.

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. \$27,600 = PV of an ordinary annuity of \$6,900 for five periods at? percent.

$\frac{\$27{,}600}{\$6{,}900}$ = PV of an ordinary annuity for five periods at? percent.

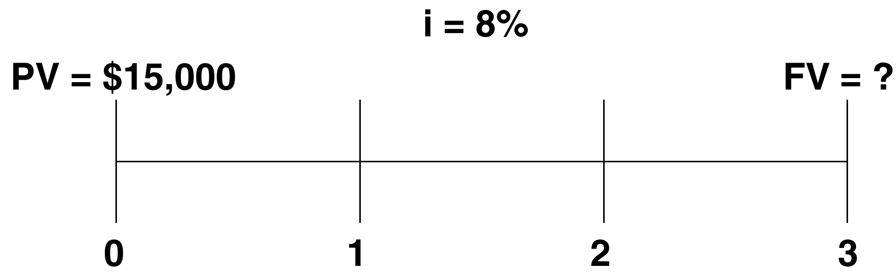
4.0 = PV of an ordinary annuity for five periods at? percent
4.0 = approximately 8%.

19. The taxing authority 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 may therefore be higher as well.

SOLUTIONS TO BRIEF EXERCISES

BRIEF EXERCISE 6-1

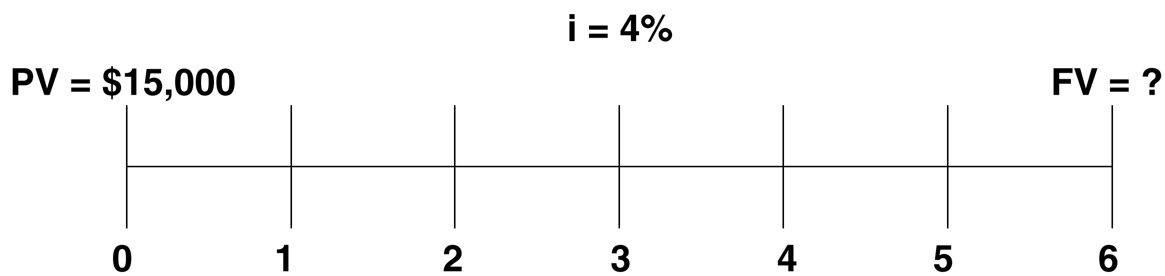
<u>8% annual interest</u>



n = 3

FV = $15,000 ($FVF_{3,\ 8\%}$)
FV = $15,000 (1.25971)
FV = $18,895.65

<u>8% annual interest, compounded semiannually</u>

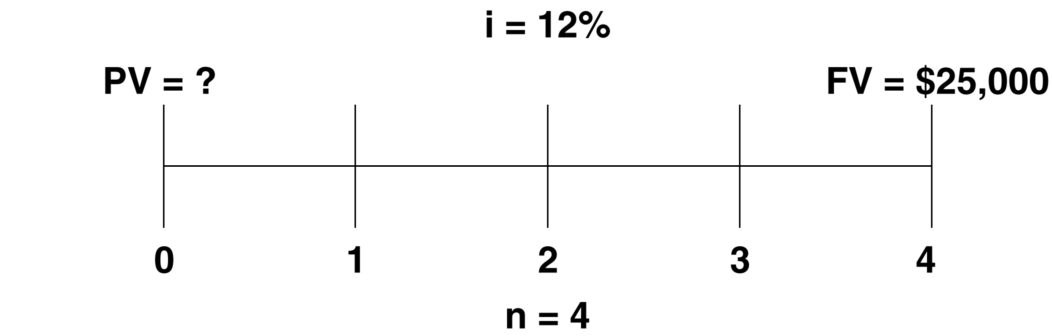


n = 6

FV = $15,000 ($FVF_{6,\ 4\%}$)
FV = $15,000 (1.26532)
FV = $18,979.80

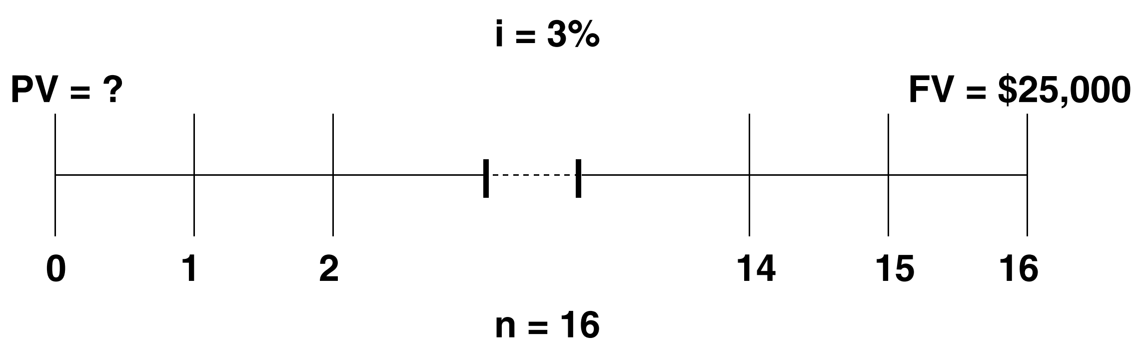
BRIEF EXERCISE 6-2

<u>12% annual interest</u>



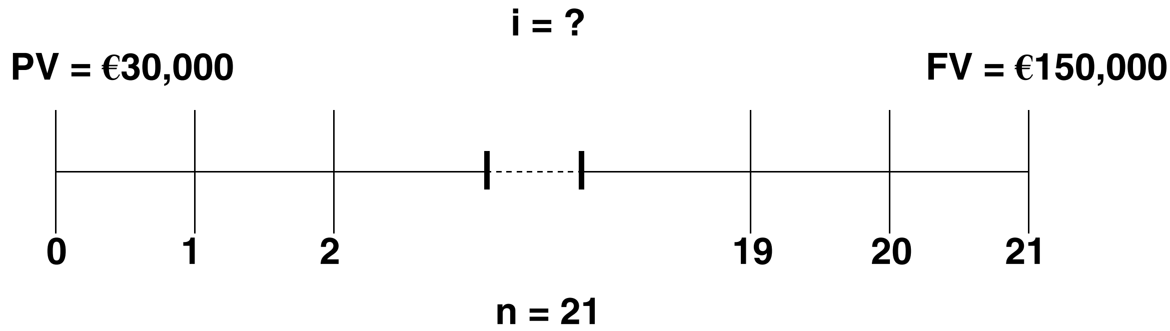
$$PV = \$25{,}000\ (PVF_{4,\ 12\%})$$
$$PV = \$25{,}000\ (.63552)$$
$$PV = \$15{,}888$$

<u>12% annual interest, compounded quarterly</u>



$$PV = \$25{,}000\ (PVF_{16,\ 3\%})$$
$$PV = \$25{,}000\ (.62317)$$
$$PV = \$15{,}579.25$$

BRIEF EXERCISE 6-3



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

$$€150{,}000 = €30{,}000\ (FVF_{21,\ i})$$

$$FVF_{21,\ i} = 5.0000$$

$$i = 8\%$$

OR

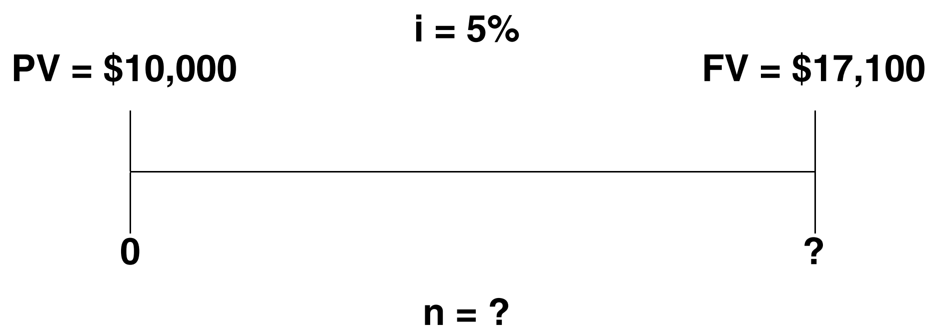
$$PV = FV\ (PVF_{21,\ i})$$

$$€30{,}000 = €150{,}000\ (PVF_{21,\ i})$$

$$PVF_{21,\ i} = .20000$$

$$i = 8\%$$

BRIEF EXERCISE 6-4



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

$$\$17{,}100 = \$10{,}000\ (FVF_{n,\ 5\%})$$

$$FVF_{n,\ 5\%} = 1.71000$$

$$n = 11 \text{ years}$$

OR

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

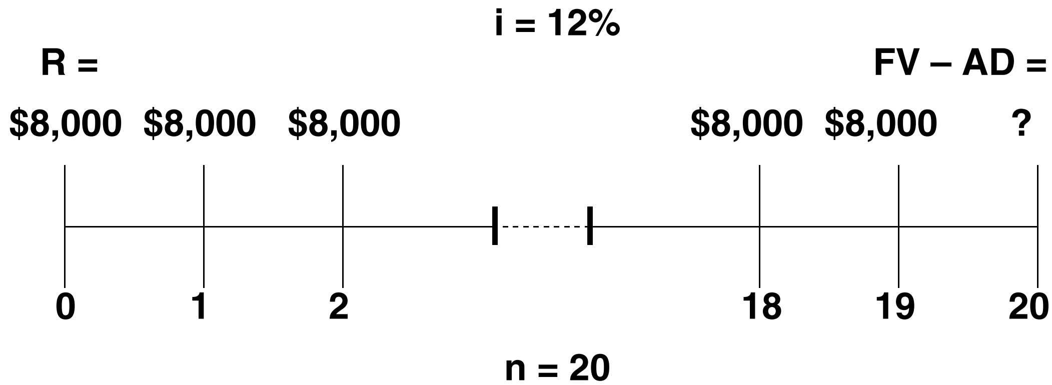
$$\$10{,}000 = \$17{,}100\ (PVF_{n,\ 5\%})$$

$$PVF_{n,\ 5\%} = .58480$$

$$n = 11 \text{ years}$$

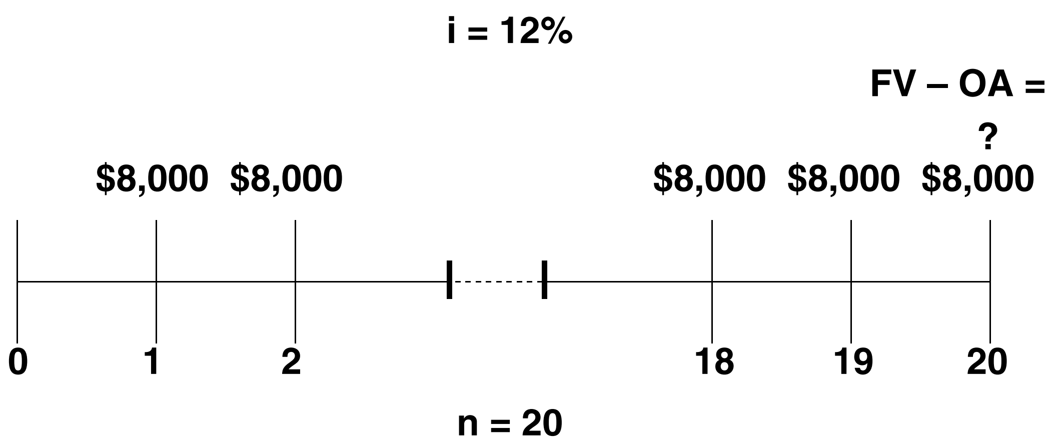
BRIEF EXERCISE 6-5

<u>First payment today (Annuity Due)</u>



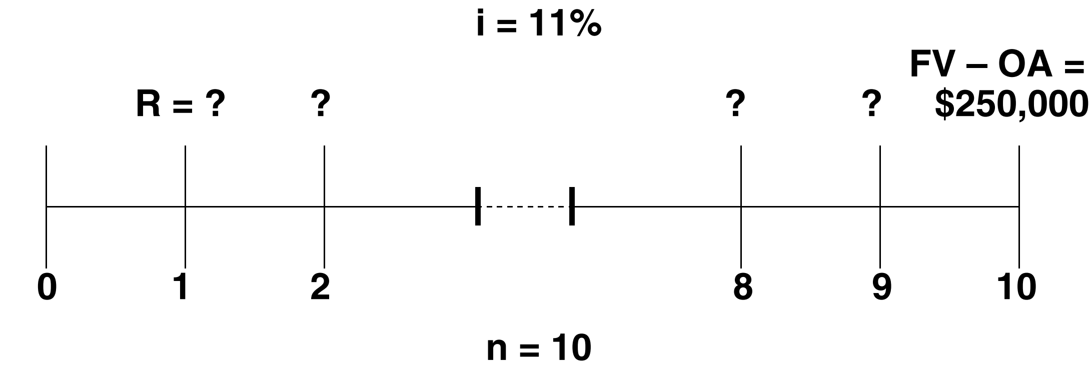
$$FV - AD = \$8{,}000\ (FVF - OA_{20,\ 12\%})\ 1.12$$
$$FV - AD = \$8{,}000\ (72.05244)\ 1.12$$
$$FV - AD = \$645{,}589.86$$

<u>First payment at year-end (Ordinary Annuity)</u>



$$FV - OA = \$8{,}000\ (FVF - OA_{20,\ 12\%})$$
$$FV - OA = \$8{,}000\ (72.05244)$$
$$FV - OA = \$576{,}419.52$$

BRIEF EXERCISE 6-6



$$\$250,000 = R\,(FVF - OA_{10,\ 11\%})$$

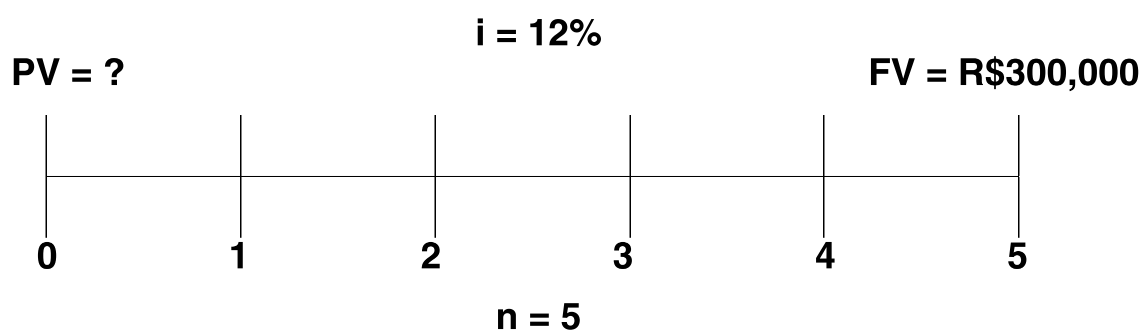
$$\$250,000 = R\,(16.72201)$$

$$\frac{\$250,000}{16.72201} = R$$

$$R = \$14,950$$

BRIEF EXERCISE 6-7

<u>12% annual interest</u>



$$PV = R\$300,000\,(PVF_{5,\ 12\%})$$

$$PV = R\$300,000\,(.56743)$$

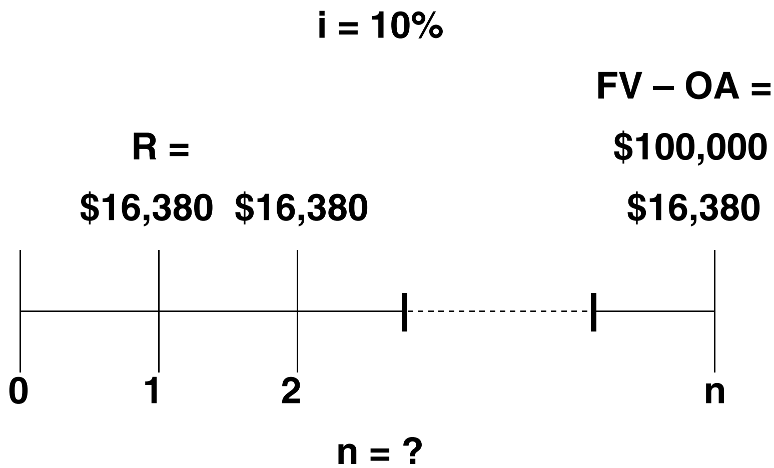
$$PV = R\$170,229$$

BRIEF EXERCISE 6-8

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

$$\text{PV} = \text{R\$300,000 } (\text{PVF}_{20,\ 3\%})$$
$$\text{PV} = \text{R\$300,000 } (.55368)$$
$$\text{PV} = \text{R\$166,104}$$

BRIEF EXERCISE 6-9



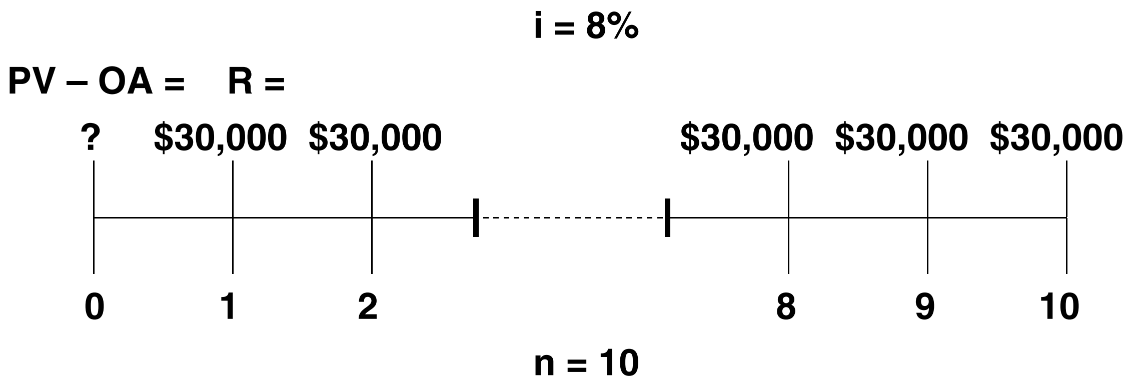
$$\$100{,}000 = \$16{,}380\ (\text{FVF} - \text{OA}_{n,\ 10\%})$$

$$\text{FVF} - \text{OA}_{n,\ 10\%} = \frac{\$100{,}000}{16{,}380} = 6.10501$$

Therefore, n = 5 years

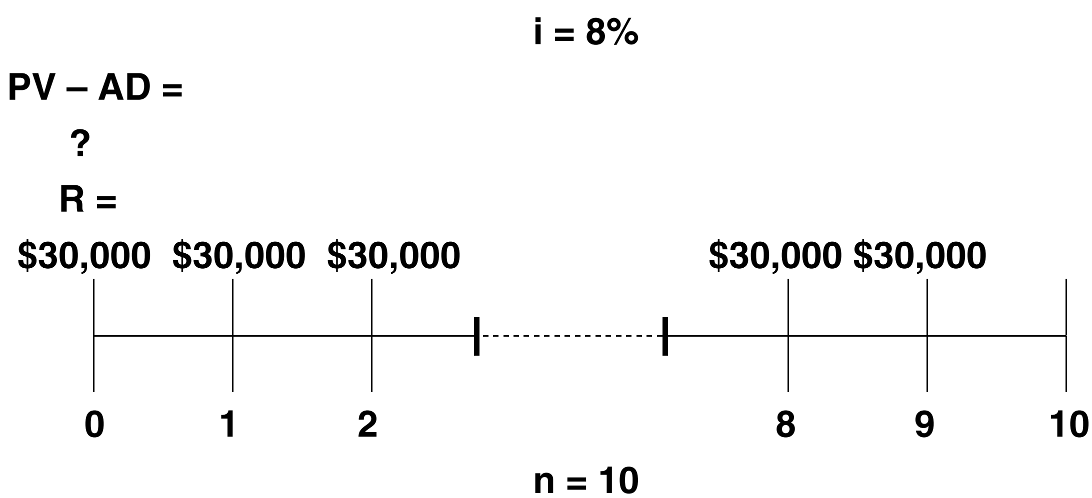
BRIEF EXERCISE 6-10

First withdrawal at year-end



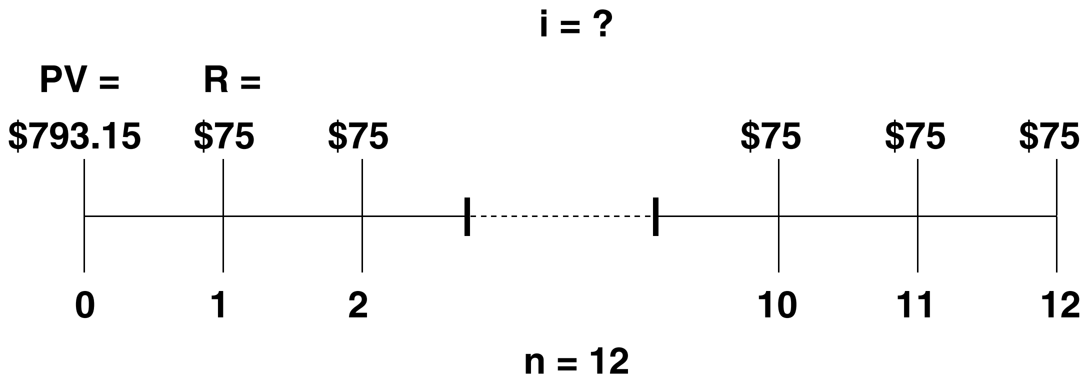
PV – OA = $30,000 (PVF – OA$_{10,\ 8\%}$)
PV – OA = $30,000 (6.71008)
PV – OA = $201,302

First withdrawal immediately



PV – AD = $30,000 (PVF – AD$_{10,\ 8\%}$)
PV – AD = $30,000 (7.24689)
PV – AD = $217,407

BRIEF EXERCISE 6-11

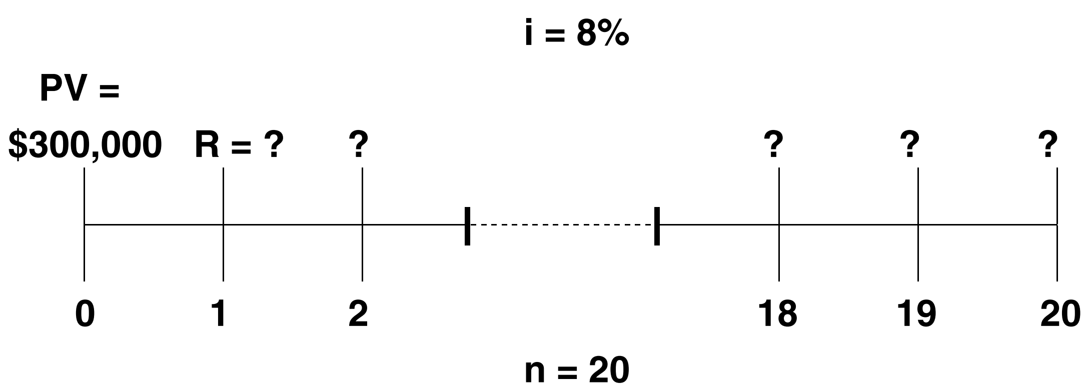


$$\$793.15 = \$75\ (PVF - OA_{12,\ i})$$

$$PVF_{12,\ i} = \frac{\$793.15}{\$75} = 10.57533$$

Therefore, i = 2% per month or 24% per year.

BRIEF EXERCISE 6-12

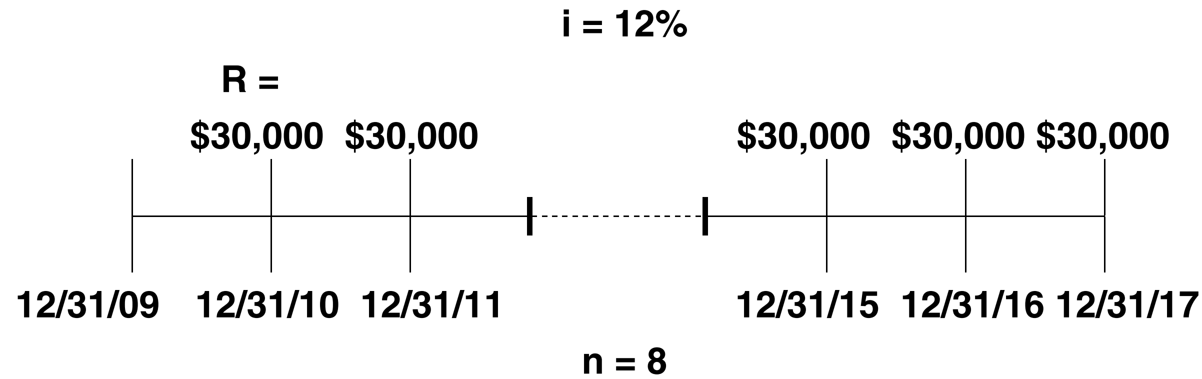


$$\$300,000 = R\ (PVF - OA_{20,\ 8\%})$$

$$\$300,000 = R\ (9.81815)$$

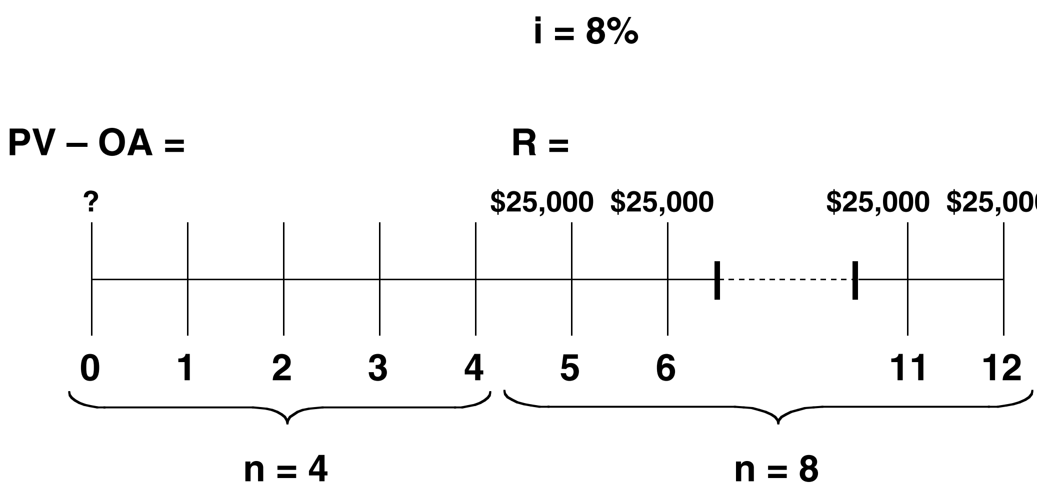
$$R = \$30,556$$

BRIEF EXERCISE 6-13



FV – OA = $30,000 (FVF – OA$_{8,\ 12\%}$)
FV – OA = $30,000 (12.29969)
FV – OA = $368,991

BRIEF EXERCISE 6-14



PV – OA = $25,000 (PVF – OA$_{12–4,\ 8\%}$)

OR

PV – OA = $25,000 (PVF – OA$_{8,\ 8\%}$)(PVF$_{4,\ 8\%}$)

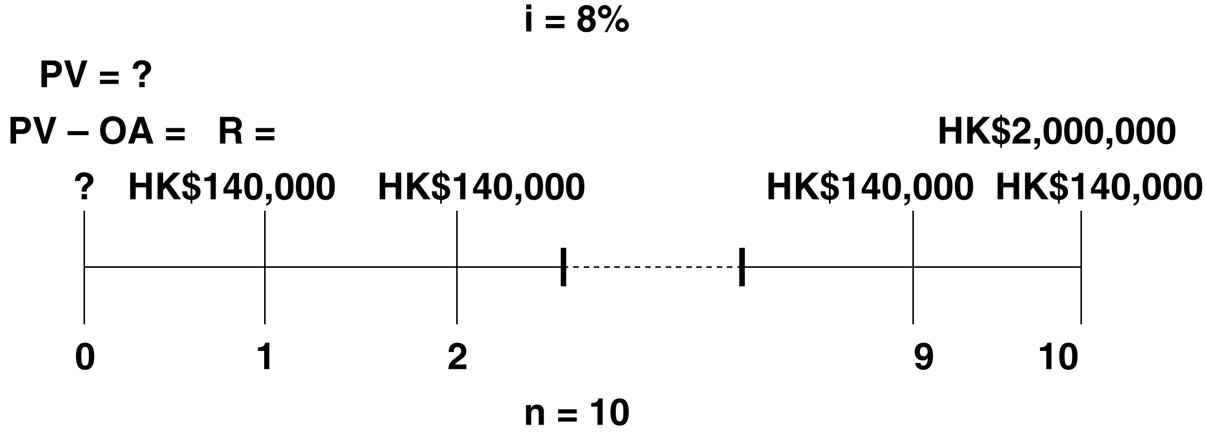
PV – OA = $25,000 (7.53608 – 3.31213)

PV – OA = $25,000 (5.74664)(.73503)

PV – OA = $105,599

PV – OA = $105,599

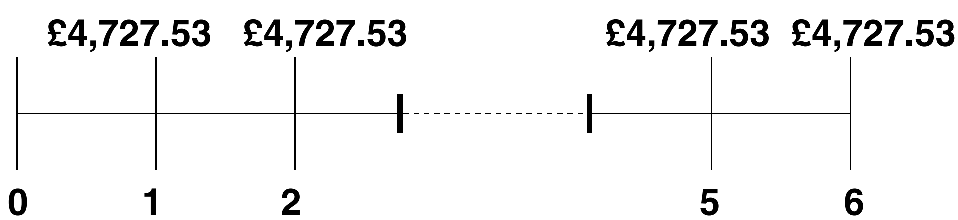
BRIEF EXERCISE 6-15



HK$2,000,000 ($PVF_{10, 8\%}$) = HK$2,000,000 (.46319)	= HK$	926,380
HK$140,000 ($PVF – OA_{10, 8\%}$) = HK$140,000 (6.71008)		939,411
		HK$1,865,791

BRIEF EXERCISE 6-16

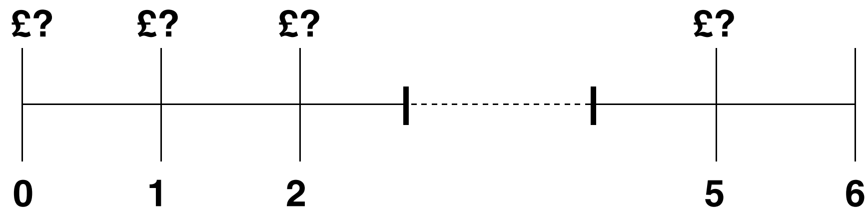
PV – OA = £20,000



£20,000	= £4,727.53 ($PV – OA_{6, i\%}$)
($PV – OA_{6, i\%}$)	= £20,000 ÷ £4,727.53
($PV – OA_{6, i\%}$)	= 4.23054
Therefore, i%	= 11

BRIEF EXERCISE 6-17

PV – AD = £20,000



£20,000 = Payment ($PV - AD_{6,\ 11\%}$)
£20,000 ÷ ($PV - AD_{6,\ 11\%}$) = Payment
£20,000 ÷ 4.6959 = £4,259.03

SOLUTIONS TO EXERCISES

EXERCISE 6-1 (5–10 minutes)

		(a) Rate of Interest	(b) Number of Periods
1.	a.	9%	9
	b.	2%	20
	c.	5%	30
2.	a.	9%	25
	b.	4%	30
	c.	3%	28

EXERCISE 6-2 (5–10 minutes)

(a)	Simple interest of $2,400 ($30,000 X 8%) per year X 8	$19,200
	Principal	30,000
	Total withdrawn	$49,200
(b)	Interest compounded annually—Future value of 1 @ 8% for 8 periods	1.85093
		X $30,000
	Total withdrawn	$55,527.90
(c)	Interest compounded semiannually—Future value of 1 @ 4% for 16 periods	1.87298
		X $30,000
	Total withdrawn	$56,189.40

EXERCISE 6-3 (10–15 minutes)

(a) €9,000 X 1.46933 = €13,223.97.

(b) €9,000 X .43393 = €3,905.37.

(c) €9,000 X 31.77248 = €285,952.32.

(d) €9,000 X 12.46221 = €112,159.89.

EXERCISE 6-4 (15–20 minutes)

(a)	Future value of an ordinary annuity of $5,000 a period for 20 periods at 8%	$228,809.80	($5,000 X 45.76196)
	Factor (1 + .08)	X 1.08	
	Future value of an annuity due of $5,000 a period at 8%	$247,114.58	
(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 $3,000 for 6 periods at 9%	$13,457.76	($3,000 X 4.48592)
	Factor (1 + .09)	X 1.09	
	Present value of an annuity due of $3,000 for 6 periods at 9%	$14,668.96	(Or see Table 6-5)

EXERCISE 6-5 (10–15 minutes)

(a) $50,000 X 4.96764 = $248,382.

(b) $50,000 X 8.31256 = $415,628.

(c) ($50,000 X 3.03735 X .50663) = $76,940.63.
or (5.65022 – 4.11141) X $50,000 = $76,940.50 (difference of $.13 due to rounding).

EXERCISE 6-6 (15–20 minutes)

(a)	Future value of ¥1,200,000 @ 10% for 10 years (¥1,200,000 X 2.59374) =	¥ 3,112,488
(b)	Future value of an ordinary annuity of ₩620,000 at 10% for 15 years (₩620,000 X 31.77248)	₩19,698,937.00
	Deficiency (₩20,000,000 – ₩19,698,937)	₩ 301,063.00
(c)	R$75,000 discounted at 8% for 10 years: R$75,000 X .46319 =	R$ 34,739.25

Accept the bonus of R$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 6-7 (12–17 minutes)

(a)	$100,000 X .31524	=	$ 31,524.00
	+ $10,000 X 8.55948	=	85,594.80
			$117,118.80
(b)	$100,000 X .23939	=	$ 23,939.00
	+ $10,000 X 7.60608	=	76,060.80
			$ 99,999.80

The answer should be $100,000; the above computation is off by 20¢ due to rounding.

(c)	$100,000 X .18270	=	$18,270.00
	+ $10,000 X 6.81086	=	68,108.60
			$86,378.60

EXERCISE 6-8 (10–15 minutes)

(a)	Present value of an ordinary annuity of 1 for 4 periods @ 8%	3.31213
	Annual withdrawal	X $25,000
	Required fund balance on June 30, 2013	$82,803.25

(b) Fund balance at June 30, 2013 / Future value of an ordinary annuity at 8% for 4 years

$$\frac{\$82{,}803.25}{4.50611} = \$18{,}375.77$$

Amount of each of four contributions is $18,375.77

EXERCISE 6-9 (5–10 minutes)

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

$\$118{,}810 = \$100{,}000\ (FVF_{2,\ i\%})$
$\$118{,}810 \div \$100{,}000 = (FVF_{2,\ i\%})$
$1.1881 = (FVF_{2,\ i\%})$—reading across the n = 2 row reveals that i = 9%.

Note: This problem can also be solved using present value tables.

EXERCISE 6-10 (10–15 minutes)

(a) The number of interest periods is calculated by first dividing the future value of $1,000,000 by $148,644, which is 6.72748—the value $1.00 would accumulate to at 10% for the unknown number of interest periods. The factor 6.72748 or its approximate is then located in the Future Value of 1 Table by reading down the 10% column to the 20-period line; thus, 20 is the unknown number of years Chopra 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 $239,392, which is 4.17725—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 10% column; thus, 10% is the interest rate Elvira must earn on her investment to become a millionaire.

EXERCISE 6-11 (10–15 minutes)

(a) **Total interest = Total payments—Amount owed today**
€155,820 (10 X €15,582) – €100,000 = €55,820.

(b) **Rossi should borrow from the bank, since the 8% rate is lower than the manufacturer's 9% rate determined below.**

$PV – OA_{10,\ i\%}$ = €100,000 ÷ €15,582
= 6.41766—Inspection of the 10 period row reveals a rate of 9%.

EXERCISE 6-12 (10–15 minutes)

Building A—PV = $610,000.

Building B—
Rent X (PV of annuity due of 25 periods at 12%) = PV
$70,000 X 8.78432 = PV
$614,902.40 = PV

Building C—
Rent X (PV of ordinary annuity of 25 periods at 12%) = PV
$6,000 X 7.84314 = PV
$47,058.84 = PV

Cash purchase price	**$650,000.00**
PV of rental income	**– 47,058.84**
Net present value	**$602,941.16**

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

EXERCISE 6-13 (15–20 minutes)

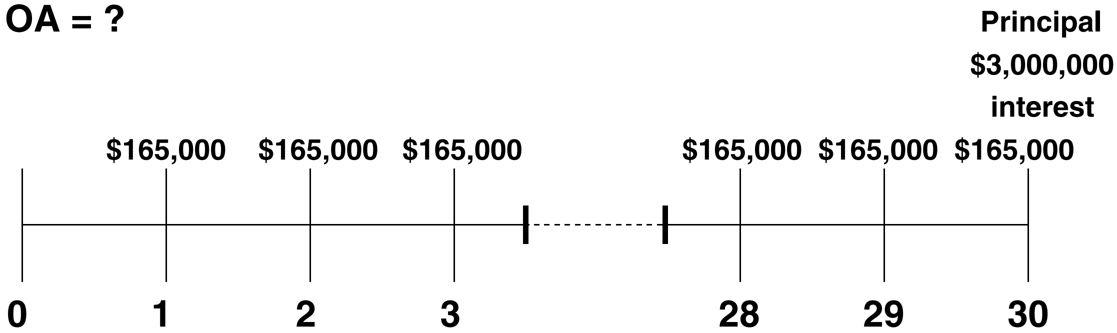
Time diagram:

Messier, Inc.

PV = ?

PV – OA = ?

i = 5%



n = 30

Formula for the interest payments:

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

$$PV - OA = \$165{,}000\,(PVF - OA_{30,\,5\%})$$

$$PV - OA = \$165{,}000\,(15.37245)$$

$$PV - OA = \underline{\underline{\$2{,}536{,}454}}$$

Formula for the principal:

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

$$PV = \$3{,}000{,}000\,(PVF_{30,\,5\%})$$

$$PV = \$3{,}000{,}000\,(0.23138)$$

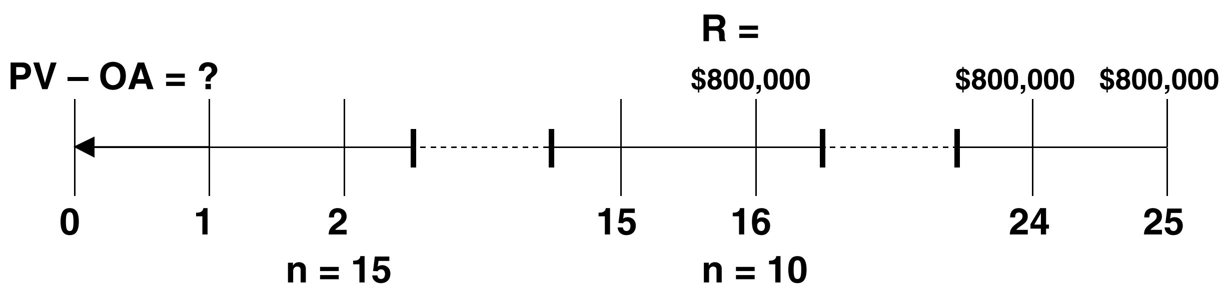
$$PV = \underline{\underline{\$694{,}140}}$$

The selling price of the bonds = $2,536,454 + $694,140 = $3,230,594.

EXERCISE 6-14 (15–20 minutes)

Time diagram:

i = 8%



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

$PV - OA = \$800{,}000\ (PVF - OA_{25-15,\ 8\%})$

$PV - OA = \$800{,}000\ (10.67478 - 8.55948)$

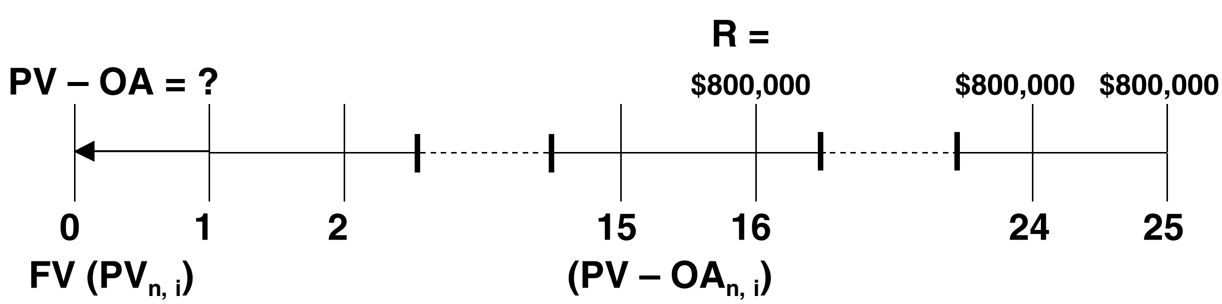
$PV - OA = \$800{,}000\ (2.11530)$

$PV - OA = \underline{\underline{\$1{,}692{,}240}}$

OR

Time diagram:

i = 8%



EXERCISE 6-14 (Continued)

(i) **Present value of the expected annual pension payments at the end of the 10th year:**

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

$$PV - OA = \$800{,}000\ (PVF - OA_{10,\ 8\%})$$

$$PV - OA = \$800{,}000\ (6.71008)$$

$$PV - OA = \underline{\underline{\$5{,}368{,}064}}$$

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

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

$$PV = \$5{,}368{,}064\ (PVF_{15,8\%})$$

$$PV = \$5{,}368{,}064\ (0.31524)$$

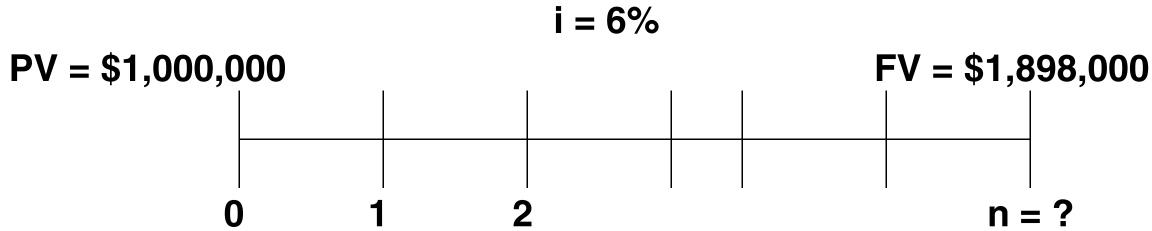
$$PV = \underline{\underline{\$1{,}692{,}228}}^{*}$$

*$12 difference due to rounding.

The company's pension obligation (liability) is $1,692,228.

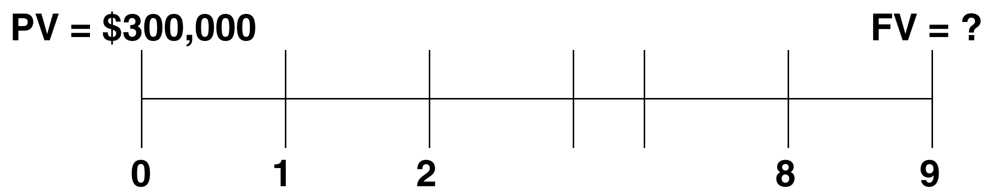
EXERCISE 6-15 (15–20 minutes)

(a)

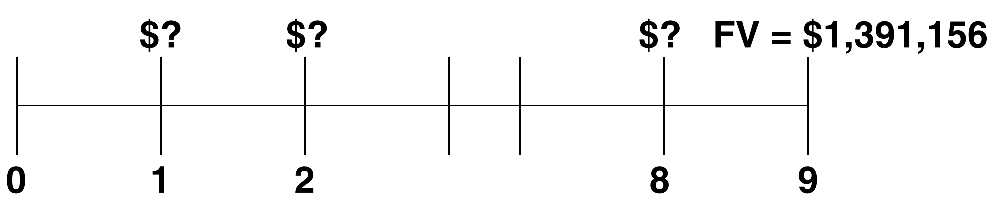


$FVF_{(n,\ 8\%)}$ = \$1,898,000 ÷ \$1,000,000
= 1.898
reading down the 6% column, 1.898 corresponds to 11 periods.

(b) By setting aside \$300,000 now, Lee can gradually build the fund to an amount to establish the foundation.



FV = \$300,000 ($FVF_{9,\ 6\%}$)
= \$300,000 (1.68948)
= \$506,844—Thus, the amount needed from the annuity:
\$1,898,000 – \$506,844 = \$1,391,156.

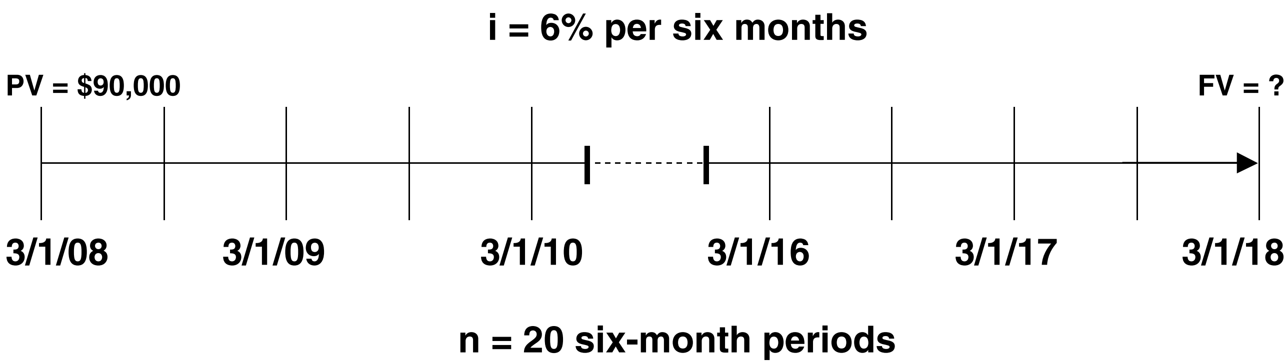


Payments = FV ÷ (FV – $OA_{9,\ 6\%}$)
= \$1,391,156 ÷ 11.49132
= \$121,061.46.

EXERCISE 6-16 (10–15 minutes)

Amount to be repaid on March 1, 2018.

Time diagram:

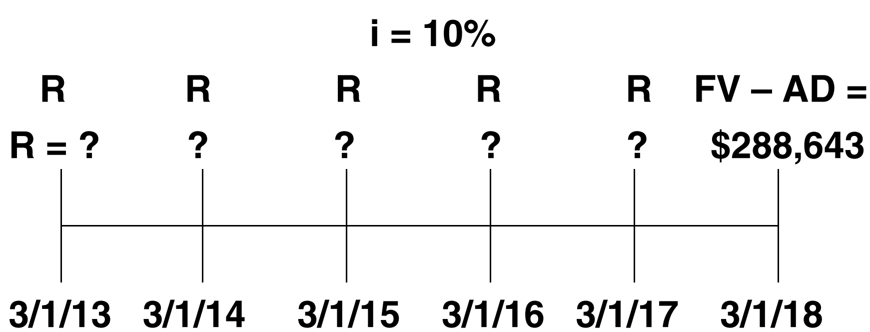


Formula:

$$FV = PV\ (FVF_{n,\ i})$$
$$FV = \$90{,}000\ (FVF_{20,\ 6\%})$$
$$FV = \$90{,}000\ (3.20714)$$
$$FV = \underline{\underline{\$288{,}643}}$$

Amount of annual contribution to debt retirement fund.

Time diagram:

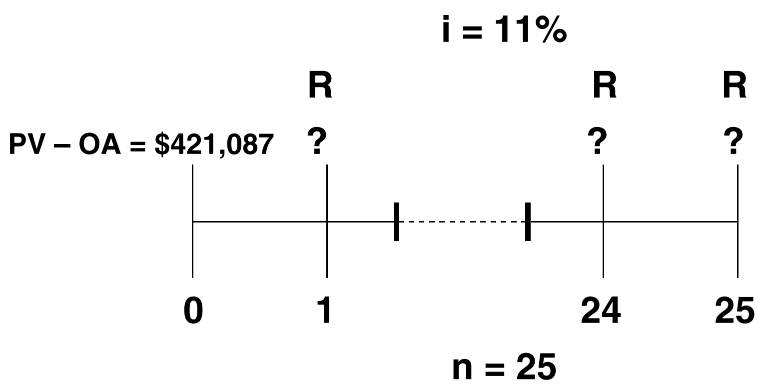


EXERCISE 6-16 (Continued)

1.	Future value of ordinary annuity of 1 for 5 periods at 10%	6.10510
2.	Factor (1 + .10)	X 1.10000
3.	Future value of an annuity due of 1 for 5 periods at 10%	6.71561
4.	Periodic rent ($288,643 ÷ 6.71561)	$42,981

EXERCISE 6-17 (10–15 minutes)

Time diagram:



Formula:

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

$$\$421{,}087 = R\,(PVF - OA_{25,\,11\%})$$

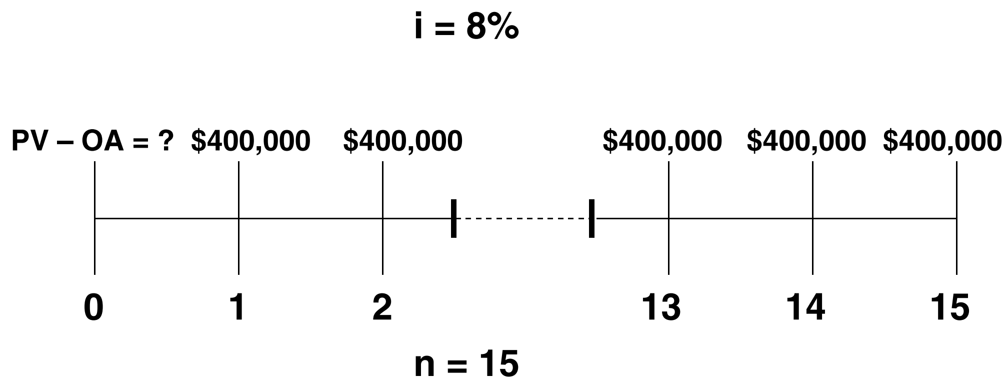
$$\$421{,}087 = R\,(8.42174)$$

$$R = \$421{,}087 \div 8.42174$$

$$R = \underline{\underline{\$50{,}000}}$$

EXERCISE 6-18 (10–15 minutes)

Time diagram:



Formula:

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

$$PV - OA = \$400{,}000\,(PVF - OA_{15,\,8\%})$$

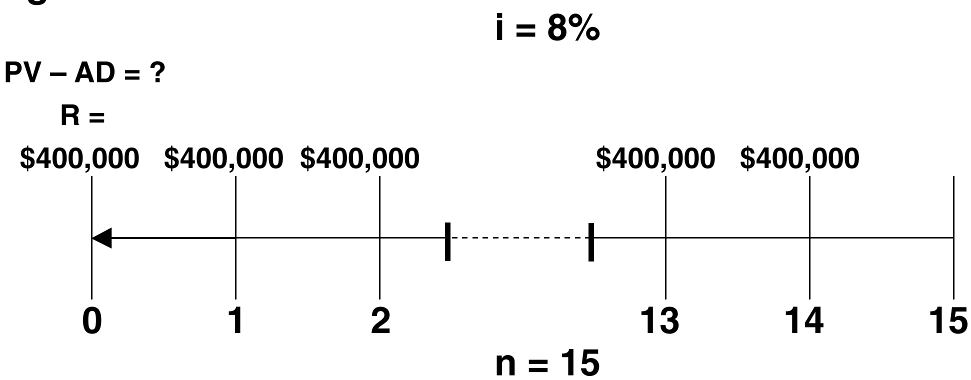
$$PV - OA = \$400{,}000\,(8.55948)$$

$$R = \underline{\underline{\$3{,}423{,}792}}$$

The recommended method of payment would be the 15 annual payments of $400,000, since the present value of those payments ($3,423,792) is less than the alternative immediate cash payment of $3,500,000.

EXERCISE 6-19 (10–15 minutes)

Time diagram:



Formula:

<u>Using Table 6-4</u>

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

$PV - AD = \$400{,}000\ (8.55948 \times 1.08)$

$PV - AD = \$400{,}000\ (9.24424)$

PV – AD = $\underline{\underline{\$3,697,696}}$

<u>Using Table 6-5</u>

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

$PV - AD = \$400{,}000\ (PVF - AD_{15,\ 8\%})$

$PV - AD = \$400{,}000\ (9.24424)$

PV – AD = $\underline{\underline{\$3,697,696}}$

The recommended method of payment would be the immediate cash payment of $3,500,000, since that amount is less than the present value of the 15 annual payments of $400,000 ($3,697,696).

EXERCISE 6-20 (15–20 minutes)

	Cash Flow Estimate	X	Probability Assessment	=	Expected Cash Flow
(a)	£4,800		20%		£ 960
	6,300		50%		3,150
	7,500		30%		2,250
			Total Expected Value		£6,360
(b)	£5,400		30%		£1,620
	7,200		50%		3,600
	8,400		20%		1,680
			Total Expected Value		£6,900
(c)	£(1,000)		10%		£ (100)
	3,000		80%		2,400
	5,000		10%		500
			Total Expected Value		£2,800

EXERCISE 6-21 (10–15 minutes)

Estimated Cash Outflow	X	Probability Assessment	=	Expected Cash Flow	X PV Factor, n = 2, i = 6%	Present Value
$200		10%		$ 20		
450		30%		135		
600		50%		300		
750		10%		75		
				$ 530	X 0.89	$471.70

EXERCISE 6-22 (15–20 minutes)

(a) This exercise determines the present value of an ordinary annuity or expected cash flows as a fair value estimate.

Cash flow Estimate	X	Probability Assessment	= Expected Cash Flow	X PV – OA Factor, n = 8, I = 8%	Present Value
$ 380,000		20%	$ 76,000		
630,000		50%	315,000		
750,000		30%	225,000		
			$ 616,000	X 5.74664	$ 3,539,930

The fair value estimate of the trade name exceeds the carrying value; thus, no impairment is recorded.

(b) This fair value is based on unobservable inputs—Killroy's own data on the expected future cash flows associated with the trade name. This fair value estimate is considered Level 3.

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 more difficult for the student because a zero-interest-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 present value of the costs of competing contracts. The student is required to decide which contract to accept.

Problem 6-4 (Time 20–30 minutes)
Purpose—to present the student with an opportunity to determine the present value of two lottery payout alternatives. The student is required to decide which payout option to choose.

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 amounts. 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 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 6-7 (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.

Problem 6-8 (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.

Time and Purpose of Problems (Continued)

Problem 6-9 (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 6-10 (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 6-11 (Time 25–30 minutes)
Purpose—to present the student an opportunity to apply present value to retirement funding problems, including deferred annuities.

Problem 6-12 (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.

Problem 6-13 (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 6-14 (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.

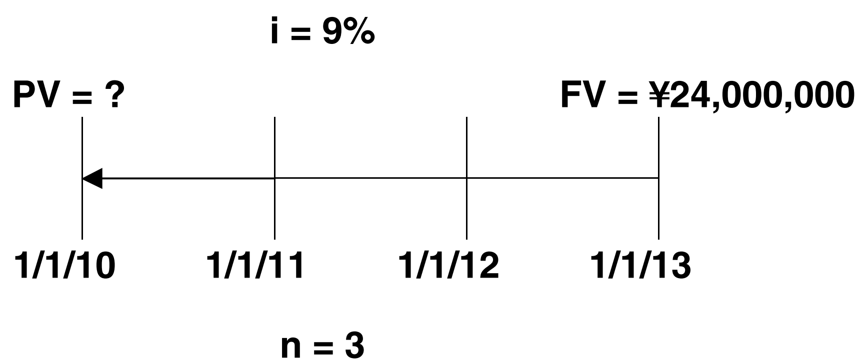
Problems 6-15 (Time 20–25 minutes)
Purpose—to present the student an opportunity to estimate fair value by computing expected cash flows and then applying present value techniques to value an environmental liability.

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

$PV = ¥24{,}000{,}000\ (PVF_{3,\ 9\%})$

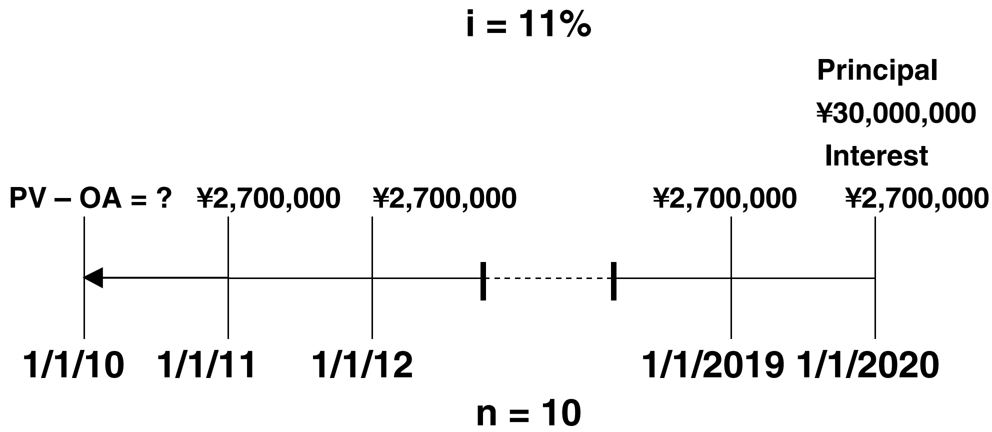
$PV = ¥24{,}000{,}000\ (.77218)$

$PV = \underline{\underline{¥18{,}532{,}320}}$

Cash equivalent price of building	¥18,532,320
Less: Book value (¥25,000,000 – ¥10,000,000)	15,000,000
Gain on disposal of the building	¥ 3,532,320

PROBLEM 6-1 (Continued)

(b) Time diagram:



Present value of the principal

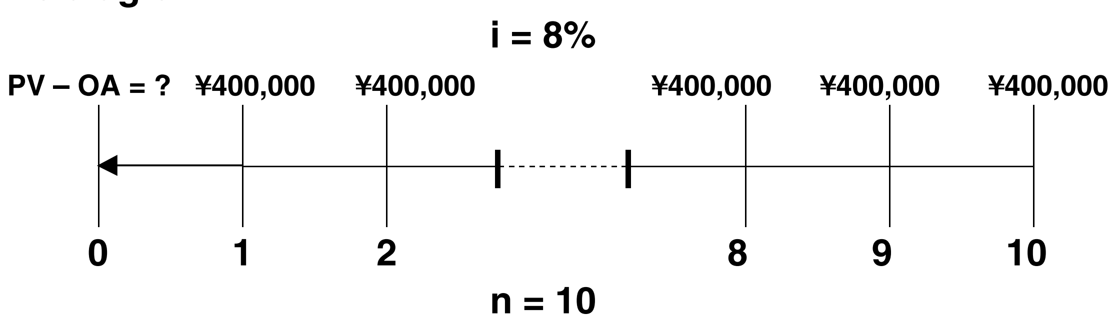
FV ($PVF_{10,\ 11\%}$) = ¥30,000,000 (.35218) .... = ¥10,565,400

Present value of the interest payments

R ($PVF – OA_{10,\ 11\%}$) = ¥2,700,000 (5.88923).......... = 15,900,921

Combined present value (purchase price).................... ¥26,466,321

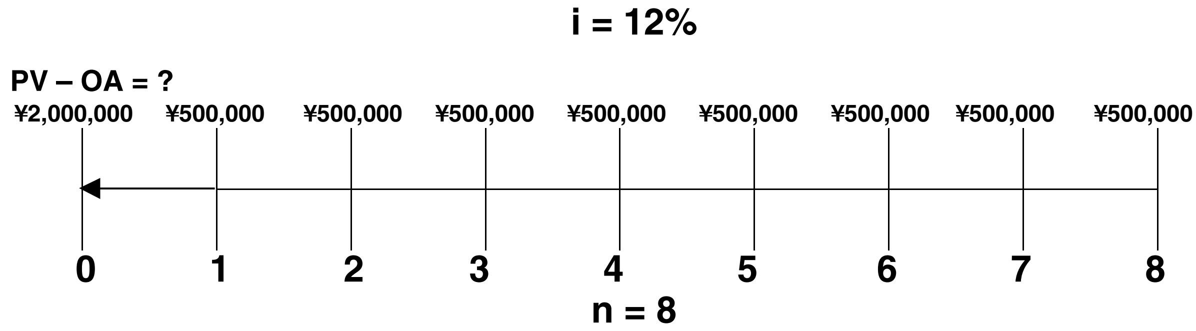
(c) Time diagram:



Formula: PV – OA = R ($PVF – OA_{n,i}$)
PV – OA = ¥400,000 ($PVF – OA_{10,\ 8\%}$)
PV – OA = ¥400,000 (6.71008)
PV – OA = ¥2,684,032 (cost of machine)

PROBLEM 6-1 (Continued)

(d) Time diagram:



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

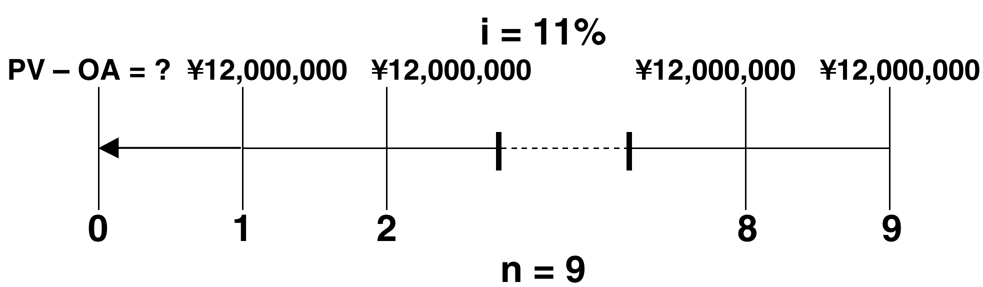
$PV - OA = ¥500{,}000\,(PVF - OA_{8,\ 12\%})$

$PV - OA = ¥500{,}000\,(4.96764)$

$PV - OA = \underline{\underline{¥2{,}483{,}820}}$

Cost of tractor = ¥2,000,000 + ¥2,483,820 = $\underline{\underline{¥4{,}483{,}820}}$

(e) Time diagram:



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

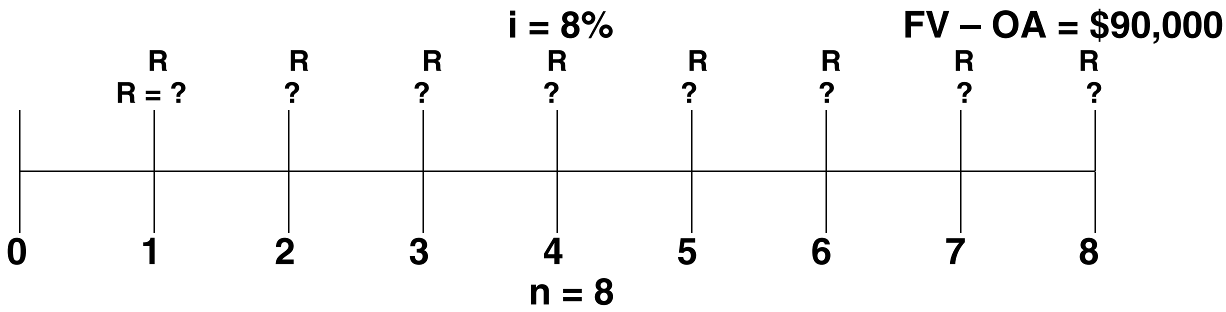
$PV - OA = ¥12{,}000{,}000\,(PVF - OA_{9,\ 11\%})$

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

$PV - OA = \underline{\underline{¥66{,}444{,}600}}$

PROBLEM 6-2

(a) Time diagram:



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

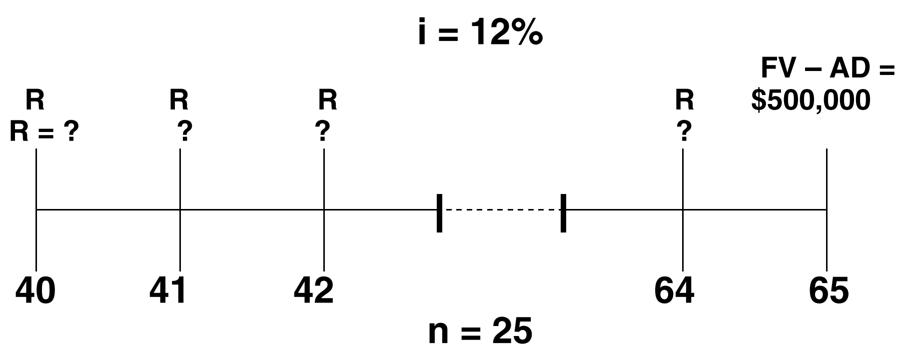
$$\$90{,}000 = \text{R}\ (\text{FVF} - \text{OA}_{8,\ 8\%})$$

$$\$90{,}000 = \text{R}\ (10.63663)$$

$$\text{R} = \$90{,}000 \div 10.63663$$

$$\text{R} = \underline{\underline{\$8{,}461.33}}$$

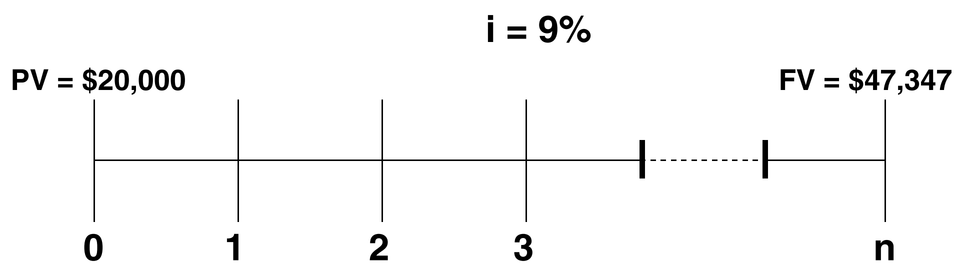
(b) Time diagram:



PROBLEM 6-2 (Continued)

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

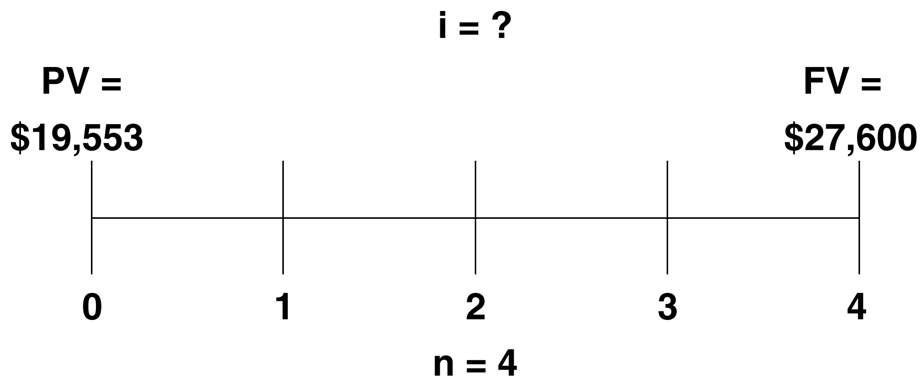
(c) Time diagram:



Future value approach		Present value approach
$FV = PV\ (FVF_{n,\ i})$	or	$PV = FV\ (PVF_{n,\ i})$
$\$47,347 = \$20,000\ (FVF_{n,\ 9\%})$		$\$20,000 = \$47,347\ (PVF_{n,\ 9\%})$
$FVF_{n,\ 9\%} = \$47,347 \div \$20,000 = \underline{\underline{2.36735}}$		$PVF_{n,\ 9\%} = \$20,000 \div \$47,347 = \underline{\underline{.42241}}$
2.36735 is approximately the value of $1 invested at 9% for 10 years.		.42241 is approximately the present value of $1 discounted at 9% for 10 years.

PROBLEM 6-2 (Continued)

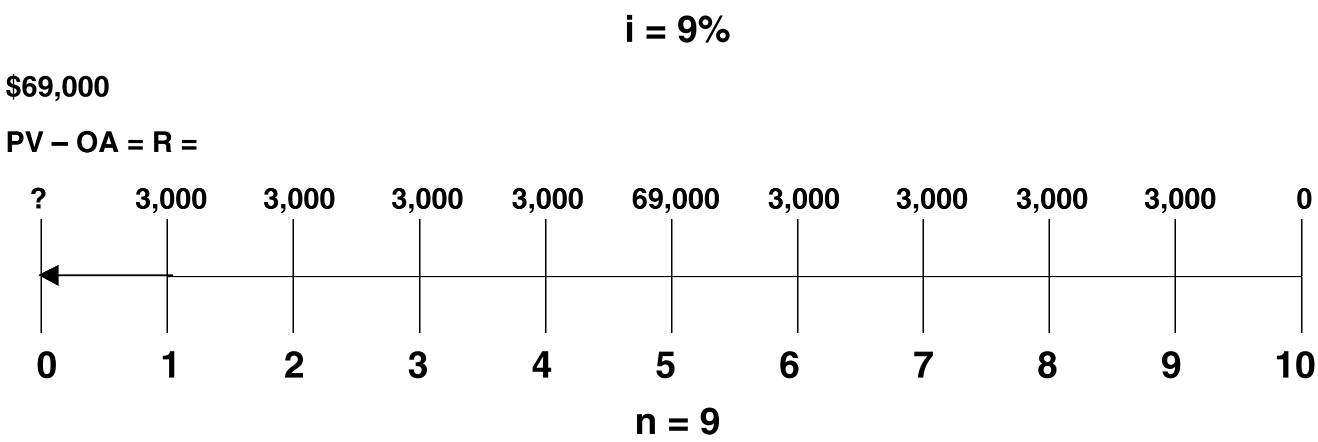
(d) Time diagram:



Future value approach		**Present value approach**
FV = PV ($FVF_{n,\,i}$)	**or**	**PV = FV ($PVF_{n,\,i}$)**
$27,600 = $19,553 ($FVF_{4,\,i}$)		**$19,553 = $27,600 ($PVF_{4,\,i}$)**
$FVF_{4,\,i}$ = $27,600 ÷ $19,553 = 1.41155		**$PVF_{4,\,i}$ = $19,553 ÷ $27,600 = .70844**
1.41155 is the value of $1 invested at 9% for 4 years.		**.70844 is the present value of $1 discounted at 9% for 4 years.**

PROBLEM 6-3

Time diagram (Bid A):



Present value of initial cost

12,000 X \$5.75 = <u>\$69,000</u> (incurred today)......................	\$ 69,000.00

Present value of maintenance cost (years 1–4)

12,000 X \$.25 = <u>\$3,000</u>

R (PVF – $OA_{4,\ 9\%}$) = \$3,000 (3.23972)................................	9,719.16

Present value of resurfacing

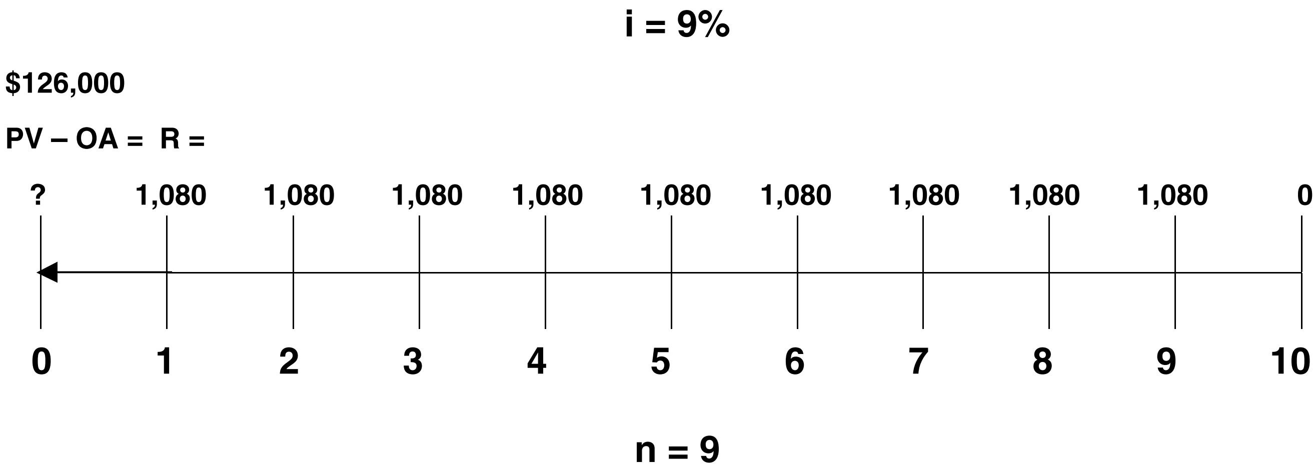
FV ($PVF_{5,\ 9\%}$) = \$69,000 (.64993)	44,845.17

Present value of maintenance cost (years 6–9)

R (PVF – $OA_{9–5,\ 9\%}$) = \$3,000 (5.99525 – 3.88965)	6,316.80
Present value of outflows for Bid A	**\$129,881.13**

PROBLEM 6-3 (Continued)

Time diagram (Bid B):



Present value of initial cost

12,000 X $10.50 = $126,000 (incurred today).............	$126,000.00

Present value of maintenance cost

12,000 X $.09 = $1,080

R ($PV – OA_{9,\ 9\%}$) = $1,080 (5.99525)................................	6,474.87
Present value of outflows for Bid B	$132,474.87

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

PROBLEM 6-4

Lump sum alternative: Present Value = $500,000 X (1 – .46) = $270,000.

Annuity alternative: Payments = $36,000 X (1 – .25) = $27,000.

Present Value = Payments ($PV - AD_{20,\ 8\%}$)
= $27,000 (10.60360)
= $286,297.20.

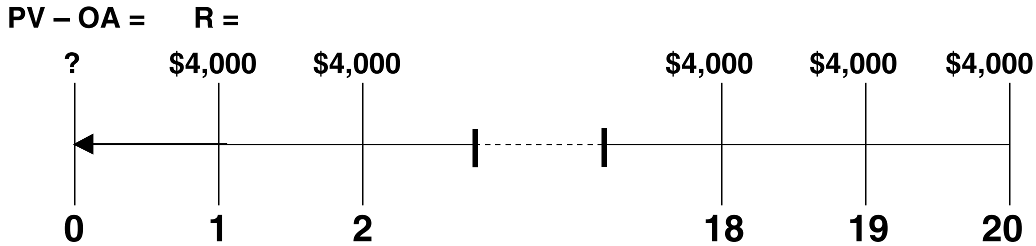
Long should choose the annuity payout; its present value is $16,297.20 greater.

PROBLEM 6-5

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

(b) Time diagram:

$i = 2^1/_2\%$ per quarter



n = 20 quarters

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

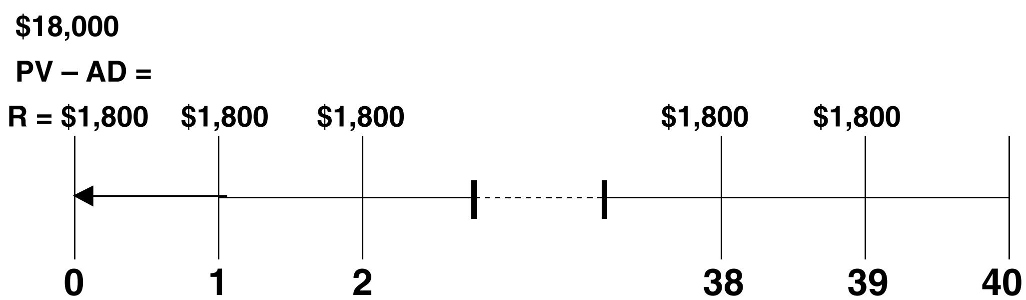
$PV - OA = \$4{,}000\ (PVF - OA_{20,\ 21/2\%})$

$PV - OA = \$4{,}000\ (15.58916)$

$PV - OA = \underline{\underline{\$62{,}356.64}}$

(c) Time diagram:

$i = 2^1/_2\%$ per quarter



n = 40 quarters

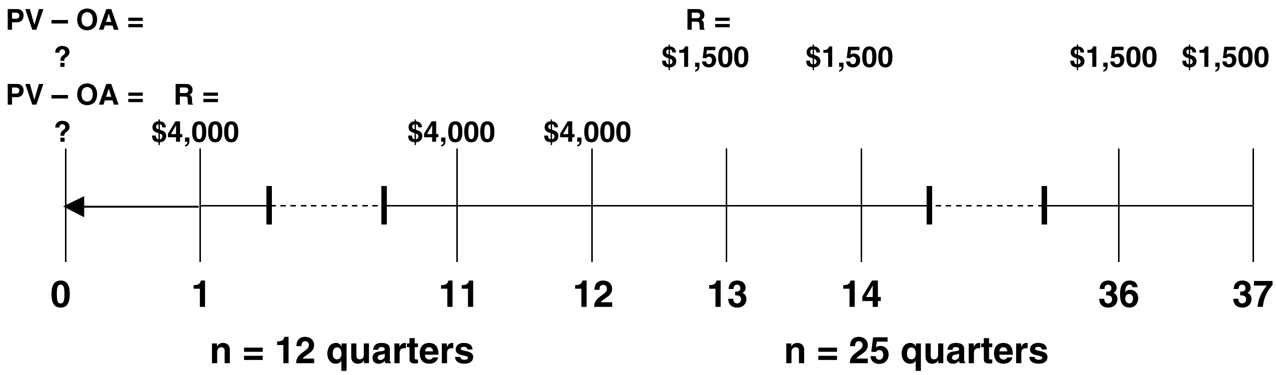
PROBLEM 6-5 (Continued)

Formula:
$$PV - AD = R\,(PVF - AD_{n,\,i})$$
$$PV - AD = \$1,800\,(PVF - AD_{40,\ 21/2\%})$$
$$PV - AD = \$1,800\,(25.73034)$$
$$PV - AD = \underline{\underline{\$46,314.61}}$$

The present value of option (c) is $18,000 + $46,314.61, or <u>$64,314.61</u>.

(d) Time diagram:

i = $2^1/_2$% per quarter



Formulas:

$$PV - OA = R\,(PVF - OA_{n,i})$$
$$PV - OA = \$4,000\,(PVF - OA_{12,\ 21/2\%})$$
$$PV - OA = \$4,000\,(10.25776)$$
$$PV - OA = \underline{\underline{\$41,031.04}}$$

$$PV - OA = R\,(PVF - OA_{n,i})$$
$$PV - OA = \$1,500\,(PVF - OA_{37-12,\ 21/2\%})$$
$$PV - OA = \$1,500\,(23.95732 - 10.25776)$$
$$PV - OA = \underline{\underline{\$20,549.34}}$$

The present value of option (d) is $41,031.04 + $20,549.34, or <u>$61,580.38</u>.

PROBLEM 6-5 (Continued)

Present values:

(a) $55,000.

(b) $62,356.64.

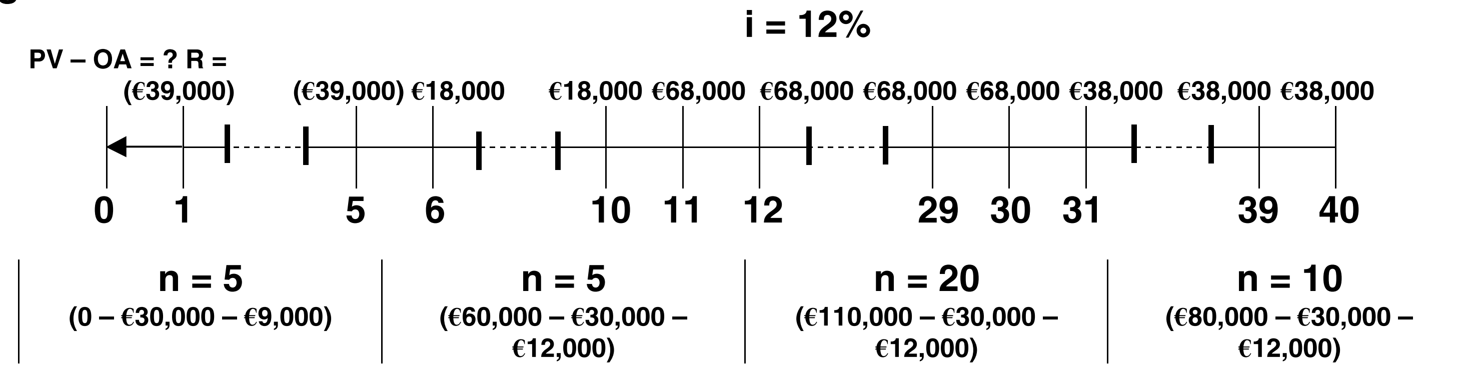
(c) $64,314.61.

(d) $61,580.38.

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

PROBLEM 6-6

Time diagram:



Formulas:

$PV - OA = R\ (PVF - OA_{n,\ i})$	$PV - OA = R\ (PVF - OA_{n,\ i})$	$PV - OA = R\ (PVF - OA_{n,\ i})$	$PV - OA = R\ (PVF - OA_{n,\ i})$
$PV - OA = (€39,000)(PVF - OA_{5,\ 12\%})$	$PV - OA = €18,000\ (PVF - OA_{10-5,\ 12\%})$	$PV - OA = €68,000\ (PVF - OA_{30-10,\ 12\%})$	$PV - OA = €38,000\ (PVF - OA_{40-30,\ 12\%})$
PV – OA = (€39,000)(3.60478)	PV – OA = €18,000 (5.65022 – 3.60478)	PV – OA = €68,000 (8.05518 – 5.65022)	PV – OA = €38,000 (8.24378 – 8.05518)
PV – OA = (€140,586.42)	PV – OA = €18,000 (2.04544)	PV – OA = €68,000 (2.40496)	PV – OA = €38,000 (.18860)
	PV – OA = €36,817.92	PV – OA = €163,537.28	PV – OA = €7,166.80

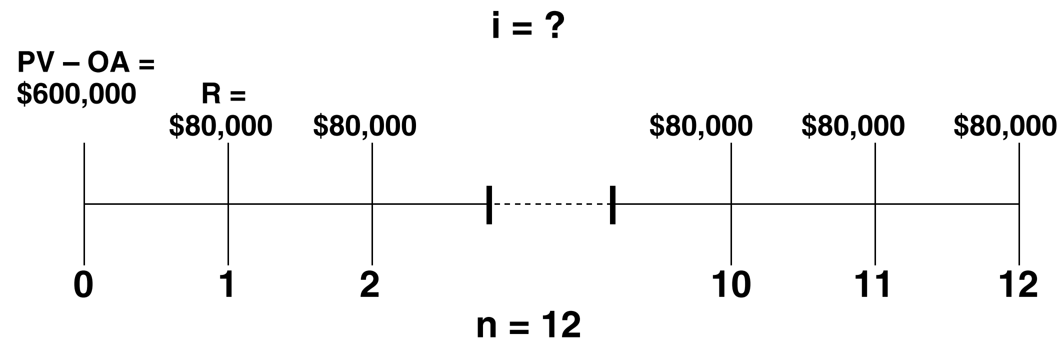
Present value of future net cash inflows:

€(140,586.42)
36,817.92
163,537.28
7,166.80
€ 66,935.58

Stacy McGill should accept no less than €66,935.58 for her vineyard business.

PROBLEM 6-7

(a) Time diagram (alternative one):



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

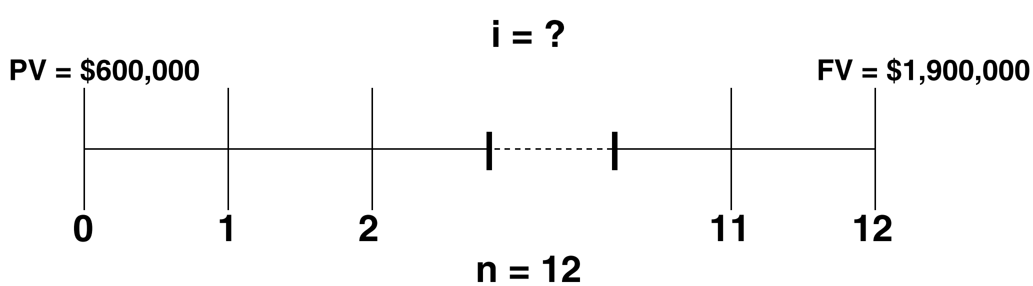
$\$600{,}000 = \$80{,}000\,(PVF - OA_{12,\,i})$

$PVF - OA_{12,\,i} = \$600{,}000 \div \$80{,}000$

$PVF - OA_{12,\,i} = \underline{\underline{7.50}}$

7.50 is the present value of an annuity of $1 for 12 years discounted at approximately 8%.

Time diagram (alternative two):



PROBLEM 6-7 (Continued)

Future value approach

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

$\$1{,}900{,}000 = \$600{,}000\ (FVF_{12,\ i})$

$FVF_{12,\ I} = \$1{,}900{,}000 \div \$600{,}000$

$FVF_{12,\ I} = \underline{\underline{3.16667}}$

3.16667 is the approximate future value of $1 invested at 10% for 12 years.

or

Present value approach

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

$\$600{,}000 = \$1{,}900{,}000\ (PVF_{12,\ i})$

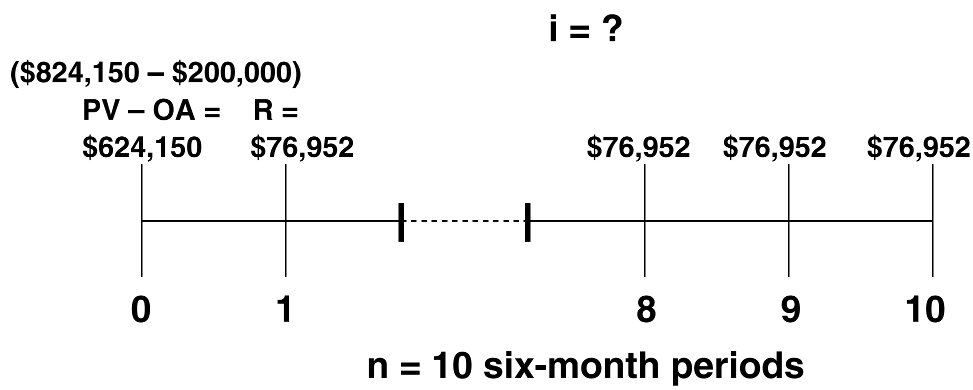
$PVF_{12,\ i} = \$600{,}000 \div \$1{,}900{,}000$

$PVF_{12,\ i} = \underline{\underline{.31579}}$

.31579 is the approximate present value of $1 discounted at 10% for 12 years.

Dubois should choose alternative two since it provides a higher rate of return.

(b) Time diagram:



PROBLEM 6-7 (Continued)

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

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

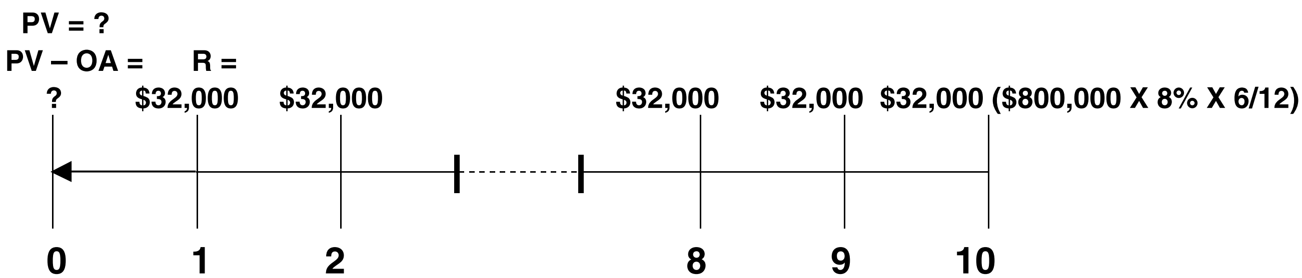
$PV - OA_{10,\,i} = \$624{,}150 \div \$76{,}952$

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

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:

i = 5% per six months



n = 10 six-month periods [(7 – 2) X 2]

Formulas:

$PV - OA = R\,(PVF - OA_{n,\,i})$	$PV = FV\,(PVF_{n,\,i})$
$PV - OA = \$32{,}000\,(PVF - OA_{10,\,5\%})$	$PV = \$800{,}000\,(PVF_{10,\,5\%})$
$PV - OA = \$32{,}000\,(7.72173)$	$PV = \$800{,}000\,(.61391)$
$PV - OA = \underline{\underline{\$247{,}095.36}}$	$PV = \underline{\underline{\$491{,}128}}$

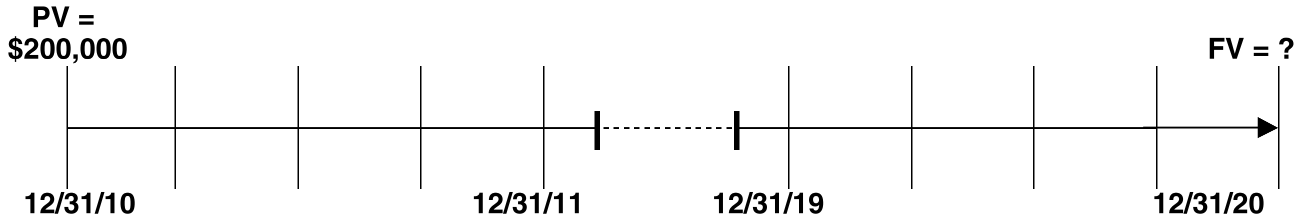
Combined present value (amount received on sale of note):

$\$247{,}095.36 + \$491{,}128 = \underline{\underline{\$738{,}223.36}}$

PROBLEM 6-7 (Continued)

(d) Time diagram (future value of $200,000 deposit)

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



n = 40 quarters

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

$FV = \$200{,}000\ (FVF_{40,\ 2\ 1/2\%})$

$FV = \$200{,}000\ (2.68506)$

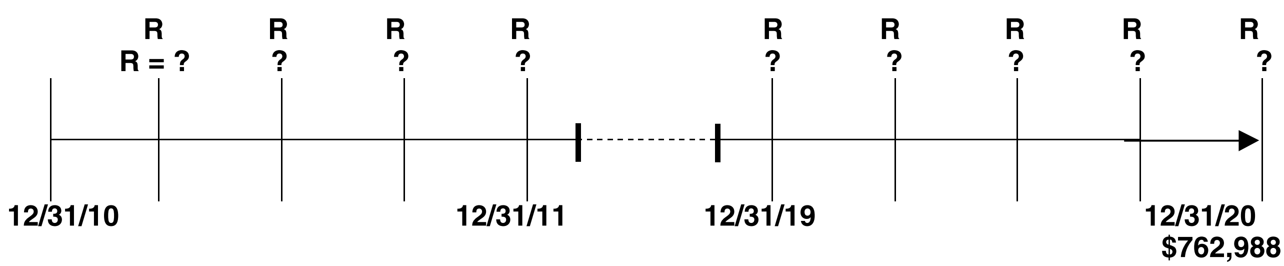
$FV = \underline{\underline{\$537{,}012}}$

Amount to which quarterly deposits must grow:

$1,300,000 – $537,012 = $762,988.

Time diagram (future value of quarterly deposits)

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



n = 40 quarters

PROBLEM 6-7 (Continued)

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

$$\$762,988 = R\ (FVF - OA_{40,\ 2\ 1/2\%})$$

$$\$762,988 = R\ (67.40255)$$

$$R = \$762,988 \div 67.40255$$

$$R = \underline{\underline{\$11,320}}$$

PROBLEM 6-8

Vendor A:	$18,000	payment
	X 6.14457	(PV of ordinary annuity 10%, 10 periods)
	$110,602.26	
	+ 55,000.00	down payment
	+ 10,000.00	maintenance contract
	$175,602.26	total cost from Vendor A
Vendor B:	$9,500	semiannual payment
	X 18.01704	(PV of annuity due 5%, 40 periods)
	$171,161.88	
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

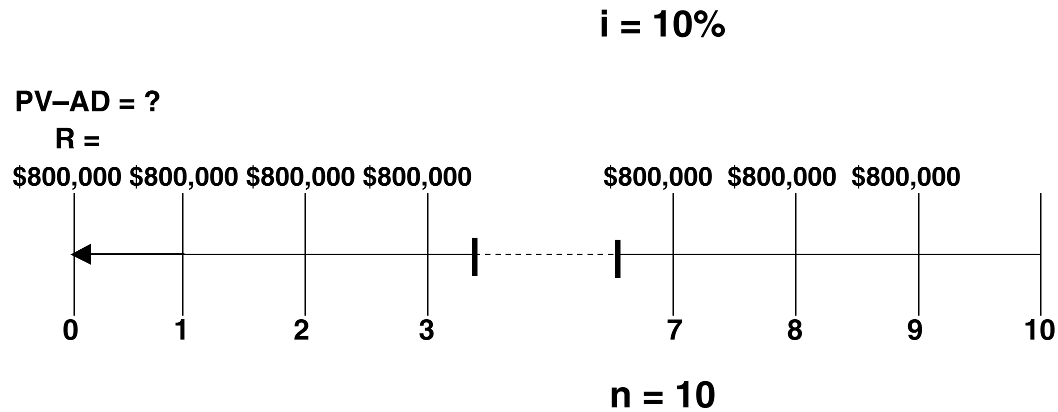
Total cost of press and maintenance Vendor C:

$150,000.00	cash purchase price
3,790.79	maintenance years 1–5
7,630.58	maintenance years 6–15
2,722.44	maintenance years 16–20
$164,143.81	

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 6-9

(a) Time diagram for the first ten payments:



Formula for the first ten payments:

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

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

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

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

Formula for the last ten payments:

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

$PV - OA = \$400,000\ (PVF - OA_{19\ -\ 9,\ 10\%})$

$PV - OA = \$400,000\ (8.36492 - 5.75902)$

$PV - OA = \$400,000\ (2.6059)$

$PV - OA = \underline{\underline{\$1,042,360}}$

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

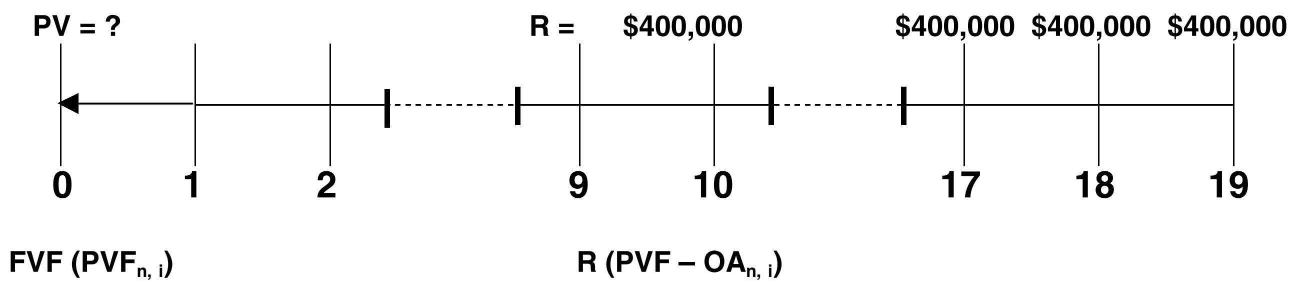
PROBLEM 6-9 (Continued)

The total cost for leasing the facilities is:
\$5,407,216 + \$1,042,360 = \$6,449,576.

OR

Time diagram for the last ten payments:

i = 10%



Formulas for the last ten payments:

(i) Present value of the last ten payments:

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

$PV - OA = \$400{,}000\ (PVF - OA_{10,\ 10\%})$

$PV - OA = \$400{,}000\ (6.14457)$

$PV - OA = \underline{\underline{\$2{,}457{,}828}}$

PROBLEM 6-9 (Continued)

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

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

$PV = \$2{,}457{,}828\ (PVF_{9,\ 10\%})$

$PV = \$2{,}457{,}828\ (.42410)$

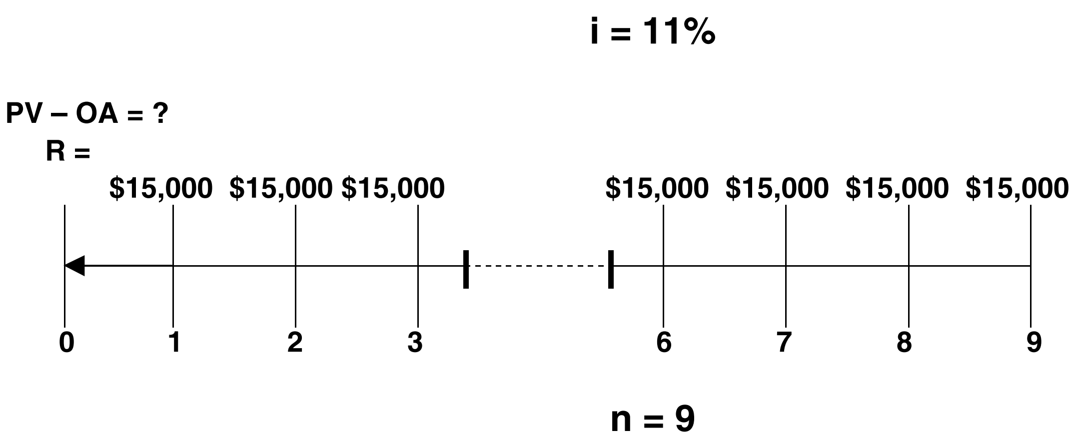
$PV = \underline{\underline{\$1{,}042{,}365}}^*$

*$5 difference due to rounding.

Cost for leasing the facilities $5,407,216 + $1,042,365 = $6,449,581

Since the present value of the cost for leasing the facilities, $6,449,581, is less than the cost for purchasing the facilities, $7,200,000, McDowell Enterprises should lease the facilities.

(b) Time diagram:



PROBLEM 6-9 (Continued)

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

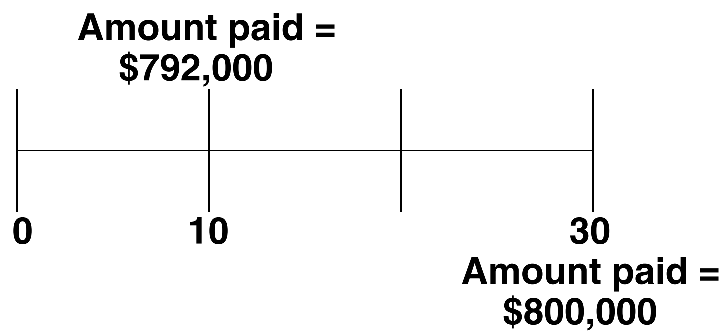
$PV - OA = \$15{,}000\ (PVF - OA_{9,\ 11\%})$

$PV - OA = \$15{,}000\ (5.53705)$

$PV - OA = \underline{\underline{\$83{,}055.75}}$

The fair value of the note is $\underline{\underline{\$83{,}055.75}}$.

(c) Time diagram:



Cash discount = \$800,000 (1%) = \$8,000
Net payment = \$800,000 – \$8,000 = \$792,000

If the company decides not to take the cash discount, then the company can use the \$792,000 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:

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

$= \$8{,}000/\$792{,}000$
$= 0.010101$

PROBLEM 6-9 (Continued)

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

Daily interest = 0.010101/20 = 0.000505
Annual interest = 0.000505 X 365 = 18.43%

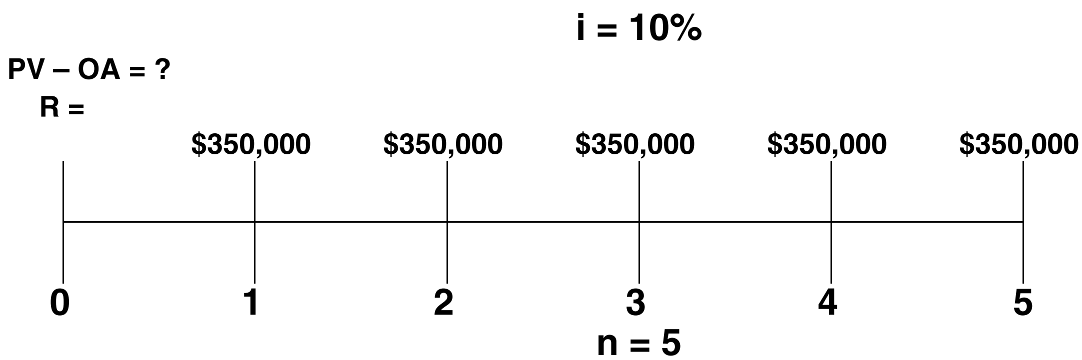
Since McDowell's cost of funds, 10%, is less than the implied interest rate for cash discount, 18.43%, it should continue the policy of taking the cash discount.

PROBLEM 6-10

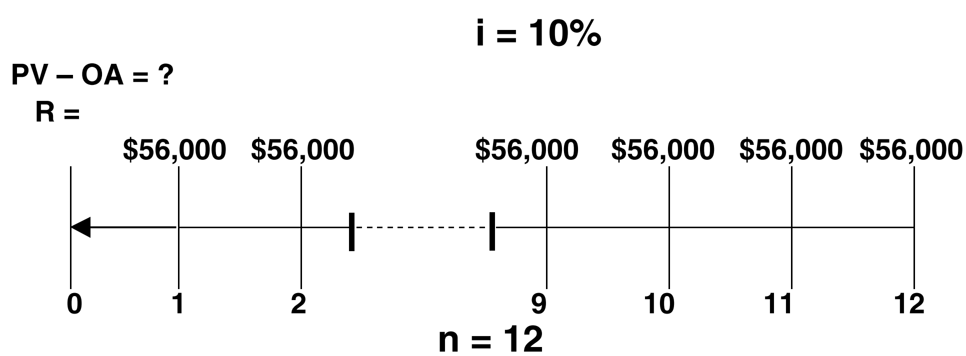
1. **Purchase.**

Time diagrams:

<u>Installments</u>



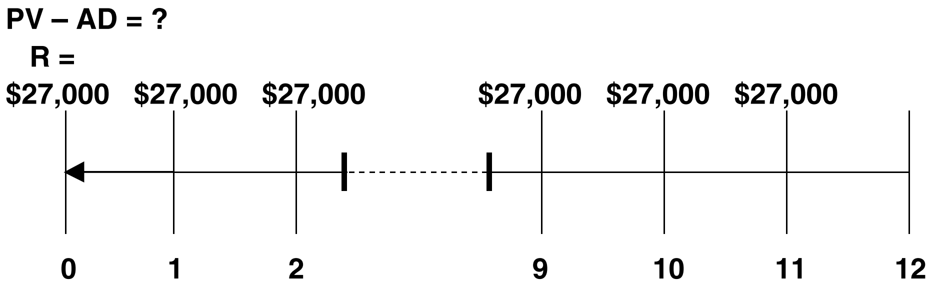
<u>Property taxes and other costs</u>



PROBLEM 6-10 (Continued)

Insurance

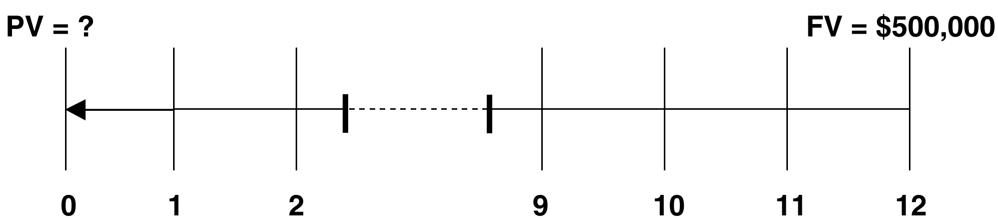
i = 10%



n = 12

Residual Value

i = 10%



n = 12

Formula for installments:

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

$$PV - OA = \$350{,}000\,(PVF - OA_{5,\,10\%})$$

$$PV - OA = \$350{,}000\,(3.79079)$$

$$PV - OA = \underline{\underline{\$1{,}326{,}777}}$$

PROBLEM 6-10 (Continued)

Formula for property taxes and other costs:

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

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

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

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

Formula for insurance:

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

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

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

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

Formula for residual value:

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

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

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

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

PROBLEM 6-10 (Continued)

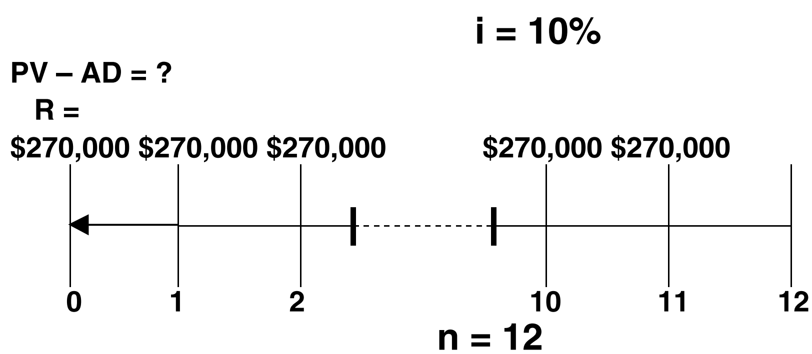
Present value of net purchase costs:

Down payment	$ 400,000
Installments	1,326,777
Property taxes and other costs	381,567
Insurance	202,367
Total costs	$2,310,711
Less: Salvage value	159,315
Net costs	$2,151,396

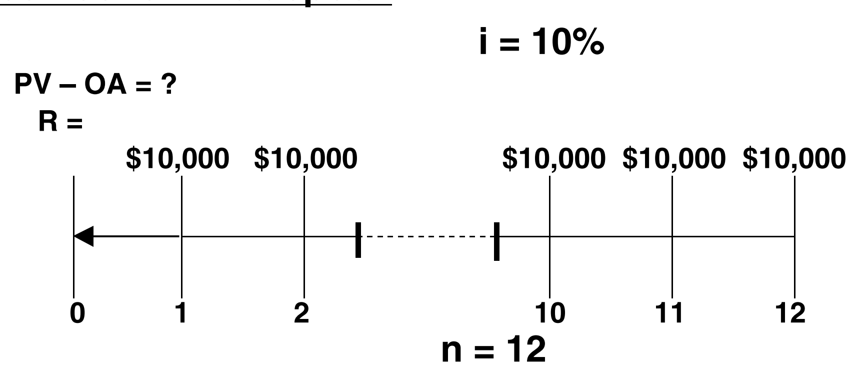
2. **Lease.**

Time diagrams:

Lease payments



Interest lost on the deposit



PROBLEM 6-10 (Continued)

Formula for lease payments:

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

$PV - AD = \$270,000\ (PVF - AD_{12,\ 10\%})$

$PV - AD = \$270,000\ (7.49506)$

$PV - AD = \underline{\underline{\$2,023,666}}$

Formula for interest lost on the deposit:

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

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

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

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

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

Cost for leasing the facilities = $2,023,666 + $68,137 = $\underline{\underline{\$2,091,803}}$

Dunn Inc. should lease the facilities because the present value of the costs for leasing the facilities, $2,091,803, is less than the present value of the costs for purchasing the facilities, $2,151,396.

***OR: $100,000 – ($100,000 X .31863) = $\underline{\underline{\$68,137}}$**

PROBLEM 6-11

(a) Annual retirement benefits.

Jean–current salary	**$ 48,000.00**	
	X 2.56330	**(future value of 1, 24 periods, 4%)**
	123,038.40	**annual salary during last year of work**
	X .50	**retirement benefit %**
	$ 61,519.00	**annual retirement benefit**
Colin–current salary	**$ 36,000.00**	
	X 3.11865	**(future value of 1, 29 periods, 4%)**
	112,271.40	**annual salary during last year of work**
	X .40	**retirement benefit %**
	$ 44,909.00	**annual retirement benefit**
Anita–current salary	**$ 18,000.00**	
	X 2.10685	**(future value of 1, 19 periods, 4%)**
	37,923.30	**annual salary during last year of work**
	X .40	**retirement benefit %**
	$ 15,169.00	**annual retirement benefit**
Gavin–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**

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

Jean will retire 10 years after deposits stop.

$ 61,519.00	annual plan benefit
X 2.69356	[PV of an annuity due for 30 periods – PV of an annuity due for 10 periods (9.02181 – 6.32825)]
$165,705.00	

Colin will retire 15 years after deposits stop.

$44,909.00	annual plan benefit
X 1.52839	[PV of an annuity due for 35 periods – PV of an annuity due for 15 periods (9.15656 – 7.62817)]
$68,638.00	

Anita will retire 5 years after deposits stop.

$15,169.00	annual plan benefit
X 4.74697	[PV of an annuity due for 25 periods – PV of an annuity due for 5 periods (8.78432 – 4.03735)]
$72,007.00	

Gavin will retire the beginning of the year after deposits stop.

$10,390.00	annual plan benefit
X 8.36578	(PV of an annuity due for 20 periods)
$86,920.00	

PROBLEM 6-11 (Continued)

$165,705.00	Jean
68,638.00	Colin
72,007.00	Anita
86,920.00	Gavin
$393,270.00	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) = $393,270.00
Deposit = $393,270.00 ÷ 41.75329
Deposit = $9,419.

PROBLEM 6-12

(a) The time value of money would suggest that NET Life's discount rate is 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 STL, Buhl 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, Buhl is responsible for the financial condition of STL. In other words, he is obligated to find ethical ways of increasing the profits of STL, even if it means switching pension funds to a less costly plan. At times, Buhl's role to retirees and his role to the corporation can be in conflict, especially if Buhl is a member of a professional group such as CAs, CPAs or CMAs.

(c) <u>If STL switched to NET Life</u>

The primary beneficiaries of Buhl's decision would be the corporation and its many shareholders by virtue of reducing £8 million of annual pension costs.

The present and future retirees of STL may be negatively affected by Buhl's decision because the chance 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).

<u>If STL stayed with First Security</u>

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

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

PROBLEM 6-13

	Cash Flow Estimate	X	Probability Assessment	=	Expected Cash Flow	X PV Factor, n = 1, I = 5%	Present Value
2011	$2,500		20%		$ 500		
	4,000		60%		2,400		
	5,000		20%		1,000		
					$3,900	0.95238	$ 3,714.28

	Cash Flow Estimate	X	Probability Assessment	=	Expected Cash Flow	X PV Factor, n = 2, I = 5%	Present Value
2012	$3,000		30%		$ 900		
	5,000		50%		2,500		
	6,000		20%		1,200		
					$4,600	0.90703	$ 4,172.34

	Cash Flow Estimate	X	Probability Assessment	=	Expected Cash Flow	X PV Factor, n = 3, I = 5%	Present Value
2013	$4,000		30%		$1,200		
	6,000		40%		2,400		
	7,000		30%		2,100		
					$5,700	0.86384	$ 4,923.89
					Total Estimated Liability		$ 12,810.51

PROBLEM 6-14

	Cash Flow Estimate X	Probability Assessment =	Expected Cash Flow		
2011	€6,000	40%	€2,400		
	9,000	60%	5,400	X PV Factor, n = 1, I = 6%	Present Value
			€7,800	0.9434	€7,358.52
2012	€ (500)	20%	€ (100)		
	2,000	60%	1,200		
	4,000	20%	800	X PV Factor, n = 2, I = 6%	Present Value
			€1,900	0.89	€1,691.00
Residual Value Received at the End of 2012	€ 500	50%	€ 250		
	900	50%	450	X PV Factor, n = 2, I = 6%	Present Value
			€ 700	0.89	€ 623.00
			Estimated Fair Value		€9,672.52

PROBLEM 6-15

(a) The expected cash flows to meet the environmental liability represent a deferred annuity. Developing a fair value estimate requires determining the present value of the annuity of expected cash flows to be paid after 10 years and then determine the present value of that amount today.

Cash Flow Estimate	X	Probability Assessment	= Expected Cash Flow	X PV – OA Factor, n = 3, I = 5%	Present Value (deferred 10 yrs)
$15,000		10%	$ 1,500		
22,000		30%	6,600		
25,000		50%	12,500		
30,000		10%	3,000		
			$23,600	X 2.72325	$64,269

The value today of the annuity payments to commence in ten years is:

$ 64,269	Present value of annuity
X .61391	PV of a lump sum to be paid in 10 periods.
$ 39,455	

Alternatively, the present value of the deferred annuity can be computed as follows:

$ 23,600	Expected cash outflows
X 1.67184	[PV of an ordinary annuity for 13 periods – PV of an annuity due for 10 periods (9.39357 – 7.72173)]
$ 39,455	

(b) This fair value estimate is based on unobservable inputs—Murphy's own data on the expected future cash flows associated with the obligation to restore the site. This fair value estimate is considered a Level 3 fair value estimate.

FINANCIAL REPORTING PROBLEM

(a) 1. Intangible assets, goodwill

For impairment of goodwill and other intangible assets, fair value is determined using a discounted cash flow analysis.

2. Retirement benefits

3. Borrowings

4. Share-based payments

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

Retirement Benefits
Financial Assumptions

	2008	2007
Discount rate	6.8%	5.3%

Share-based Payments

	2008	2007
Risk-free rate	4.6%/4.6%	5.4%/5.3%

Intangible Assets

Pre-tax discount rate	9.5%

Borrowings

Interest Rate Analysis

	2008	2007
Committed and uncommitted borrowings	5.5%	4.8%
Medium term notes	6.2%	5.9%
Finance leases	5.0%	4.0%
Partnership liability	5.7%	5.3%

2. There are 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 of $375,000 less cash outflows of $125,000 = Net cash flows of $250,000.

$250,000 X 2.48685 (PVF – $OA_{3,\ 10\%}$) = $621,713

(b) Cash inflows of $275,000 less cash outflows of $155,000 = Net cash flows of $120,000.

$120,000 X 2.48685 (PVF – $OA_{3,10\%}$) = $298,422

(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.

ACCOUNTING, ANALYSIS, AND PRINCIPLES

ACCOUNTING

(a) $\$50{,}000 \text{ X } (PVF - OA_{10,\ ?\%}) = \underline{\underline{\$320{,}883}}$

$$(PVF - OA_{10,\ ?\%}) = 6.41766$$

From Table 6-4, the interest rate is 9% for each semi-annual period. The implicit annual interest rate is 2 X 9% or 18%.

(b) **The note should be valued at its present value of $320,883.**

ANALYSIS

The note receivable consists of a fixed set of payments to be received. Therefore, if interest rates rise, the stream of payments will be worth less to Johnson. The fair value of the note receivable will decrease.

PRINCIPLES

Regulators are commonly faced with the relevance-faithful presentation trade-off. Many believe that fair values provide more relevant information because fair values provide current information as to what the value of an asset or liabilities. However, the determination of fair value may involve many assumptions such that the faithful representation of the measure suffers. Measurements of historical costs on the other hand are considered a faithful representation because the amount is based on an actual transaction. However, the relevance of historical costs decrease as the transaction is further removed.

PROFESSIONAL RESEARCH

(a) The components of present value measurement include the following elements that together capture the economic differences between assets (IAS 36, paragraph A1):

(a) an estimate of the future cash flow, or in more complex cases, series of future cash flows the entity expects to derive from the asset;

(b) expectations about possible variations in the amount or timing of those cash flows;

(c) the time value of money, represented by the current market risk-free rate of interest;

(d) the price for bearing the uncertainty inherent in the asset; and

(e) other, sometimes unidentifiable, factors (such as illiquidity) that market participants would reflect in pricing the future cash flows the entity expects to derive from the asset.

(b) Accounting applications of present value have traditionally used a single set of estimated cash flows and a single discount rate, often described as 'the rate commensurate with the risk'. In effect, the traditional approach assumes that a single discount rate convention can incorporate all the expectations about the future cash flows and the appropriate risk premium. Therefore, the traditional approach places most of the emphasis on selection of the discount rate. (IAS 36, paragraph A4).

The expected cash flow approach is, in some situations, a more effective measurement tool than the traditional approach. In developing a measurement, the expected cash flow approach uses all expectations about possible cash flows instead of the single most likely cash flow. For example, a cash flow might be CU100, CU200 or CU300 with probabilities of 10 per cent, 60 per cent and 30 per cent, respectively. The expected cash flow is CU220. The expected cash flow approach thus differs from the traditional approach by focusing on direct analysis of the cash flows in question and on more explicit statements of the assumptions used in the measurement. (IAS 36, paragraph A7).

(c) When an asset-specific rate is not directly available from the market, an entity uses surrogates to estimate the discount rate. The purpose is to estimate, as far as possible, a market assessment of:

(a) the time value of money for the periods until the end of the asset's useful life; and

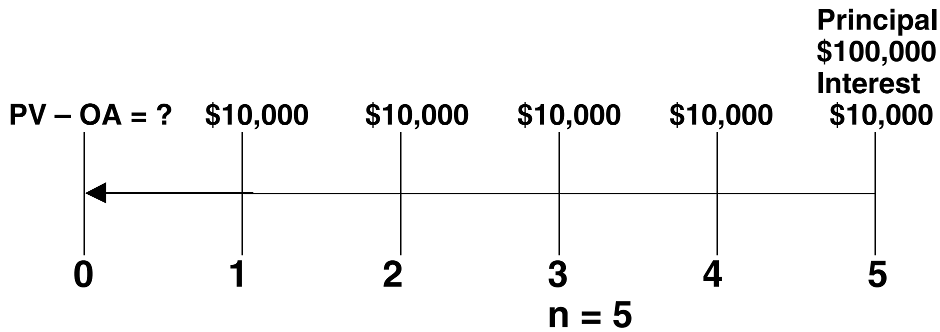
(b) factors (b), (d) and (e) described in paragraph A1, to the extent those factors have not caused adjustments in arriving at estimated cash flows.

(IAS 36, paragraph A16).

PROFESSIONAL SIMULATION

Measurement

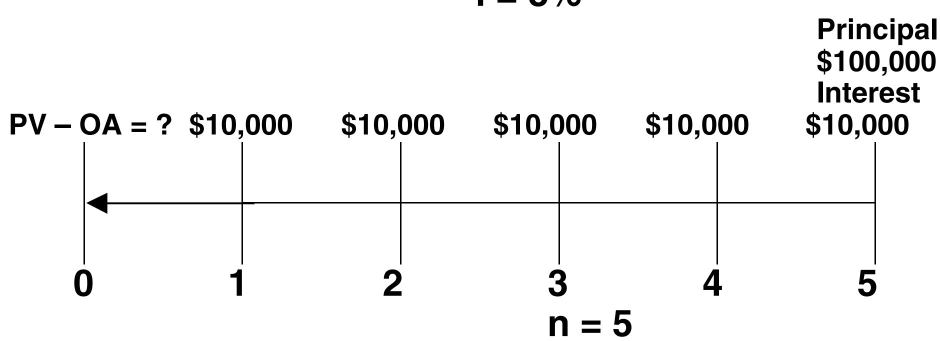
i = 12%



Present value of the principal

$FV (PVF_{5,\ 12\%}) = \$100,000\ (.56743)$	= $56,743.00
Present value of the interest payments	
$R (PVF – OA_{5,\ 12\%}) = \$10,000\ (3.60478)$	= 36,047.80
Combined present value (Proceeds)	$92,790.80

i = 8%



Present value of the principal

$FV (PVF_{5,\ 8\%}) = \$100,000\ (.68058)$	= $ 68,058.00
Present value of the interest payments	
$R (PVF – OA_{5,\ 8\%}) = \$10,000\ (3.99271)$	= 39,927.10
Combined present value (Proceeds)	$107,985.10

PROFESSIONAL SIMULATION (Continued)

12%

Inputs:	**5**	**12**	**?**	**–10000**	**–10000**
	N	**I**	**PV**	**PMT**	**FV**
Answer:			**92,790.45**		

8%

Inputs:	**5**	**8**	**?**	**–10000**	**–10000**
	N	**I**	**PV**	**PMT**	**FV**
Answer:			**107,985.42**		

Valuation

	A	B	C	D	E	F	G
1							
2	**Bond Amortization Schedule**						
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.

