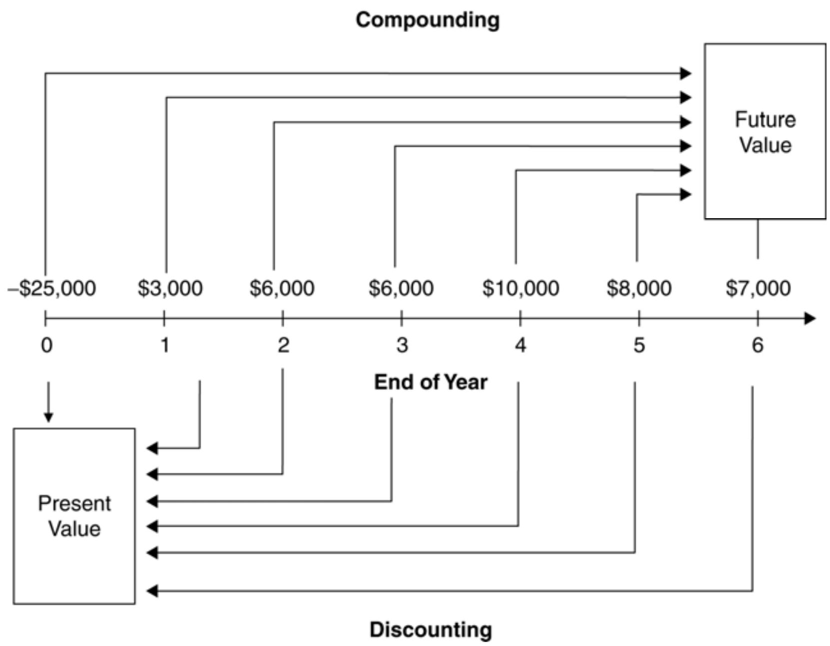
■ Solutions to Problems

P4-1. LG 1: Using a time line

Basic

a. b. and c.



d. Financial managers rely more on present value than future value because they typically make decisions before the start of a project, at time zero, as does the present value calculation.

P4-2. LG 2: Future value calculation: $FV_n = PV \times (1 + I)^n$

Basic

Case

A $FVIF_{12\%,2 \text{ periods}} = (1 + 0.12)^2 = 1.254$

B $FVIF_{6\%,3 \text{ periods}} = (1 + 0.06)^3 = 1.191$

C $FVIF_{9\%,2 \text{ periods}} = (1 + 0.09)^2 = 1.188$

D $FVIF_{3\%,4 \text{ periods}} = (1 + 0.03)^4 = 1.126$

P4-3. LG 2: Future value tables: $FV_n = PV \times (1 + I)^n$

Basic

Case A

a. $2 = 1 \times (1 + 0.07)^n$
$2/1 = (1.07)^n$
$2 = FVIF_{7\%,n}$
10 years < n < 11 years
Nearest to 10 years

b. $4 = 1 \times (1 + 0.07)^n$
$4/1 = (1.07)^n$
$4 = FVIF_{7\%,n}$
20 years < n < 21 years
Nearest to 20 years

Case B

a. $2 = 1 \times (1 + 0.40)^n$
$2 = FVIF_{40\%,n}$
2 years < n < 3 years
Nearest to 2 years

b. $4 = (1 + 0.40)^n$
$4 = FVIF_{40\%,n}$
4 years < n < 5 years
Nearest to 4 years

Case C

a. $2 = 1 \times (1 + 0.20)^n$
$2 = FVIF_{20\%,n}$
3 years < n < 4 years
Nearest to 4 years

b. $4 = (1 + 0.20)^n$
$4 = FVIF_{20\%,n}$
7 years < n < 8 years
Nearest to 8 years

Case D

a. $2 = 1 \times (1 + 0.10)^n$
$2 = FVIF_{10\%,n}$
7 years < n < 8 years
Nearest to 7 years

b. $4 = (1 + 0.10)^n$
$4 = FVIF_{40\%,n}$
14 years < n <15 years
Nearest to 15 years

P4-4. LG 2: Future values: $FV_n = PV \times (1 + I)^n$ or $FV_n = PV \times (FVIF_{i\%,n})$

Intermediate

Case

A $FV_{20} = PV \times FVIF_{5\%,20 \text{ yrs.}}$
$FV_{20} = \$200 \times (2.653)$
$FV_{20} = \$530.60$
Calculator solution: $530.66

Case

B $FV_7 = PV \times FVIF_{8\%,7 \text{ yrs.}}$
$FV_7 = \$4,500 \times (1.714)$
$FV_7 = \$7,713$
Calculator solution: $7,712.21

C

$FV_{10} = PV \times FVIF_{9\%,10\ yrs.}$
$FV_{10} = \$10,000 \times (2.367)$
$FV_{10} = \$23,670$
Calculator solution: $23,673.64

D

$FV_{12} = PV \times FVIF_{10\%,12\ yrs.}$
$FV_{12} = \$25,000 \times (3.138)$
$FV_{12} = \$78,450$
Calculator solution: $78,460.71

E

$FV_5 = PV \times FVIF_{11\%,5\ yrs.}$
$FV_5 = \$37,000 \times (1.685)$
$FV_5 = \$62,345$
Calculator solution: $62,347.15

F

$FV_9 = PV \times FVIF_{12\%,9\ yrs.}$
$FV_9 = \$40,000 \times (2.773)$
$FV_9 = \$110,920$
Calculator solution: $110,923.15

P4-5. LG 2: Personal finance: Time value: $FV_n = PV \times (1 + I)^n$ or $FV_n = PV \times (FVIF_{i\%,n})$

Intermediate

a. (1) $FV_3 = PV \times (FVIF_{7\%,3})$
$FV_3 = \$1,500 \times (1.225)$
$FV_3 = \$1,837.50$
Calculator solution: $1,837.56

(2) $FV_6 = PV \times (FVIF_{7\%,6})$
$FV_6 = \$1,500 \times (1.501)$
$FV_6 = \$2,251.50$
Calculator solution: $2,251.10

(3) $FV_9 = PV \times (FVIF_{7\%,9})$
$FV_9 = \$1,500 \times (1.838)$
$FV_9 = \$2,757.00$
Calculator solution: $2,757.69

b. (1) Interest earned = $FV_3 - PV$
Interest earned = $1,837.50
–$1,500.00
$ 337.50

(2) Interest earned = $FV_6 - FV_3$
Interest earned = $2,251.50
–$1,837.50
$ 414.00

(3) Interest earned = $FV_9 - FV_6$
Interest earned = $2,757.00
–$2,251.50
$ 505.50

c. The fact that the longer the investment period is, the larger the total amount of interest collected will be, is not unexpected and is due to the greater length of time that the principal sum of $1,500 is invested. The most significant point is that the incremental interest earned per 3-year period increases with each subsequent 3 year period. The total interest for the first 3 years is $337.50; however, for the second 3 years (from year 3 to 6) the additional interest earned is $414.00. For the third 3-year period, the incremental interest is $505.50. This increasing change in interest earned is due to compounding, the earning of interest on previous interest earned. The greater the previous interest earned, the greater the impact of compounding.

P4-6. LG 2: Personal finance: Time value

Challenge

a. (1) $FV_5 = PV \times (FVIF_{2\%,5})$
$FV_5 = \$14,000 \times (1.104)$
$FV_5 = \$15,456.00$
Calculator solution: $15,457.13

(2) $FV_5 = PV \times (FVIF_{4\%,5})$
$FV_5 = \$14,000 \times (1.217)$
$FV_5 = \$17,038.00$
Calculator solution: $17,033.14

b. The car will cost $1,582 more with a 4% inflation rate than an inflation rate of 2%. This increase is 10.2% more ($1,582 ÷ $15,456) than would be paid with only a 2% rate of inflation.

P4-7. LG 2: Personal finance: Time value

Challenge

Deposit Now:	Deposit in 10 Years:
$FV_{40} = PV \times FVIF_{9\%,40}$	$FV_{30} = PV_{10} \times (FVIF_{9\%,30})$
$FV_{40} = \$10,000 \times (1.09)^{40}$	$FV_{30} = PV_{10} \times (1.09)^{30}$
$FV_{40} = \$10,000 \times (31.409)$	$FV_{30} = \$10,000 \times (13.268)$
$FV_{40} = \$314,090.00$	$FV_{30} = \$132,680.00$
Calculator solution: $314,094.20	Calculator solution: $132,676.78

You would be better off by $181,410 ($314,090 – $132,680) by investing the $10,000 now instead of waiting for 10 years to make the investment.

P4-8. LG 2: Personal finance: Time value: $FV_n = PV \times FVIF_{i\%,n}$

Challenge

a. $\$15,000 = \$10,200 \times FVIF_{i\%,5}$
$FVIF_{i\%,5} = \$15,000 \div \$10,200 = 1.471$
$8\% < i < 9\%$
Calculator solution: 8.02%

b. $\$15,000 = \$8,150 \times FVIF_{i\%,5}$
$FVIF_{i\%,5} = \$15,000 \div \$8,150 = 1.840$
$12\% < i < 13\%$
Calculator solution: 12.98%

c. $\$15,000 = \$7,150 \times FVIF_{i\%,5}$
$FVIF_{i\%,5} = \$15,000 \div \$7,150 = 2.098$
$15\% < i < 16\%$
Calculator solution: 15.97%

P4-9. LG 2: Personal finance: Single-payment loan repayment: $FV_n = PV \times FVIF_{i\%,n}$

Intermediate

a. $FV_1 = PV \times (FVIF_{14\%,1})$
$FV_1 = \$200 \times (1.14)$
$FV_1 = \$228$
Calculator solution: $228

b. $FV_4 = PV \times (FVIF_{14\%,4})$
$FV_4 = \$200 \times (1.689)$
$FV_4 = \$337.80$
Calculator solution: $337.79

c. $FV_8 = PV \times (FVIF_{14\%,8})$
$FV_8 = \$200 \times (2.853)$
$FV_8 = \$570.60$
Calculator solution: $570.52

P4-10. LG 2: Present value calculation: $PVIF = \frac{1}{(1+i)^n}$

Basic

Case	
A	$PVIF = 1 \div (1 + 0.02)^4 = 0.9238$
B	$PVIF = 1 \div (1 + 0.10)^2 = 0.8264$
C	$PVIF = 1 \div (1 + 0.05)^3 = 0.8638$
D	$PVIF = 1 \div (1 + 0.13)^2 = 0.7831$

P4-11. LG 2: Present values: $PV = FV_n \times (PVIF_{i\%,n})$

Basic

Case		Calculator Solution
A	$PV_{12\%,4yrs}$ = \$7,000 × 0.636 = \$4,452	\$ 4,448.63
B	$PV_{8\%,\ 20yrs}$ = \$28,000 × 0.215 = \$6,020	\$ 6,007.35
C	$PV_{14\%,12yrs}$ = \$10,000 × 0.208 = \$2,080	\$ 2,075.59
D	$PV_{11\%,6yrs}$ = \$150,000 × 0.535 = \$80,250	\$80,196.13
E	$PV_{20\%,8yrs}$ = \$45,000 × 0.233 = \$10,485	\$10,465.56

P4-12. LG 2: Present value concept: $PV_n = FV_n \times (PVIF_{i\%,n})$

Intermediate

a. $PV = FV_6 \times (PVIF_{12\%,6})$
PV = \$6,000 × (.507)
PV = \$3,042.00
Calculator solution: \$3,039.79

b. $PV = FV_6 \times (PVIF_{12\%,6})$
PV = \$6,000 × (0.507)
PV = \$3,042.00
Calculator solution: \$3,039.79

c. $PV = FV_6 \times (PVIF_{12\%,6})$
PV = \$6,000 × (0.507)
PV = \$3,042.00
Calculator solution: \$3,039.79

d. The answer to all three parts are the same. In each case the same questions is being asked but in a different way.

P4-13. LG 2: Personal finance: Time value: $PV = FV_n \times (PVIF_{i\%,n})$

Basic

Jim should be willing to pay no more than \$408.00 for this future sum given that his opportunity cost is 7%.

PV = \$500 × ($PVIF_{7\%,3}$)
PV = \$500 × (0.816)
PV = \$408.00
Calculator solution: \$408.15

P4-14. LG 2: Time value: $PV = FV_n \times (PVIF_{i\%,n})$

Intermediate

PV = \$100 × ($PVIF_{8\%,6}$)
PV = \$100 × (0.630)
PV = \$63.00
Calculator solution: \$63.02

P4-15. LG 2: Personal finance: Time value and discount rates: $PV = FV_n \times (PVIF_{i\%,n})$

Intermediate

a. (1) $PV = \$1,000,000 \times (PVIF_{6\%,10})$
$PV = \$1,000,000 \times (0.558)$
$PV = \$558,000.00$
Calculator solution: $558,394.78

(2) $PV = \$1,000,000 \times (PVIF_{9\%,10})$
$PV = \$1,000,000 \times (0.422)$
$PV = \$422,000.00$
Calculator solution: $422,410.81

(3) $PV = \$1,000,000 \times (PVIF_{12\%,10})$
$PV = \$1,000,000 \times (0.322)$
$PV = \$322,000.00$
Calculator solution: $321,973.24

b. (1) $PV = \$1,000,000 \times (PVIF_{6\%,15})$
$PV = \$1,000,000 \times (0.417)$
$PV = \$417,000.00$
Calculator solution: $417,265.06

(2) $PV = \$1,000,000 \times (PVIF_{9\%,15})$
$PV = \$1,000,000 \times (0.275)$
$PV = \$275,000.00$
Calculator solution: $274,538.04

(3) $PV = \$1,000,000 \times (PVIF_{12\%,15})$
$PV = \$1,000,000 \times (0.183)$
$PV = \$183,000.00$
Calculator solution: $182,696.26

c. As the discount rate increases, the present value becomes smaller. This decrease is due to the higher opportunity cost associated with the higher rate. Also, the longer the time until the lottery payment is collected, the less the present value due to the greater time over which the opportunity cost applies. In other words, the larger the discount rate and the longer the time until the money is received, the smaller will be the present value of a future payment.

P4-16. Personal finance: LG 2: Time value comparisons of lump sums: $PV = FV_n \times (PVIF_{i\%,n})$

Intermediate

a. **A** $PV = \$28,500 \times (PVIF_{11\%,3})$
$PV = \$28,500 \times (0.731)$
$PV = \$20,833.50$
Calculator solution: $20,838.95

B $PV = \$54,000 \times (PVIF_{11\%,9})$
$PV = \$54,000 \times (0.391)$
$PV = \$21,114.00$
Calculator solution: $21,109.94

C $PV = \$160,000 \times (PVIF_{11\%,20})$
$PV = \$160,000 \times (0.124)$
$PV = \$19,840.00$
Calculator solution: $19,845.43

b. Alternatives A and B are both worth greater than $20,000 in term of the present value.

c. The best alternative is B because the present value of B is larger than either A or C and is also greater than the $20,000 offer.

P4-17. LG 2: Personal finance: Cash flow investment decision: $PV = FV_n \times (PVIF_{i\%,n})$

Intermediate

A $PV = \$30,000 \times (PVIF_{10\%,5})$
$PV = \$30,000 \times (0.621)$
$PV = \$18,630.00$
Calculator solution: $18,627.64

B $PV = \$3,000 \times (PVIF_{10\%,20})$
$PV = \$3,000 \times (0.149)$
$PV = \$447.00$
Calculator solution: $445.93

C $PV = \$10,000 \times (PVIF_{10\%,10})$
$PV = \$10,000 \times (0.386)$
$PV = \$3,860.00$
Calculator solution: $3,855.43

D $PV = \$15,000 \times (PVIF_{10\%,40})$
$PV = \$15,000 \times (0.022)$
$PV = \$330.00$
Calculator solution: $331.42

Purchase	**Do Not Purchase**
A	B
C	D

P4-18. LG 3: Future value of an annuity

Intermediate

a. Future value of an annuity

$FVA_{k\%,n} = PMT \times (FVIFA_{k\%,n})$

A $FVA_{8\%,10} = \$2,500 \times 14.487$
$FVA_{8\%,10} = \$36,217.50$
Calculator solution: $36,216.41

B $FVA_{12\%,6} = \$500 \times 8.115$
$FVA_{12\%,6} = \$4,057.50$
Calculator solution: $4,057.59

C $FVA_{20\%,5} = \$30,000 \times 7.442$
$FVA_{20\%,5} = \$223,260$
Calculator solution: $223,248

D $FVA_{9\%,8} = \$11,500 \times 11.028$
$FVA_{9\%,8} = \$126,822$
Calculator solution: $126,827.45

E $FVA_{14\%,30} = \$6,000 \times 356.787$
$FVA_{14\%,30} = \$2,140,722$
Calculator solution: $2,140,721.08

P4-19. LG 3: Present value of an annuity: $PV_n = PMT \times (PVIFA_{i\%,n})$

Intermediate

a. Present value of an annuity

$PVA_{k\%,n} = PMT \times (PVIFA_{i\%,n})$

A $PVA_{7\%,3} = \$12,000 \times 2.624$

$PVA_{7\%,3} = \$31,488$

Calculator solution: $31,491.79

B $PVA_{12\%15} = \$55,000 \times 6.811$

$PVA_{12\%,15} = \$374,605$

Calculator solution: $374,597.55

C $PVA_{20\%,9} = \$700 \times 4.031$

$PVA_{20\%,9} = \$2,821.70$

Calculator solution: $2,821.68

D $PVA_{5\%,7} = \$140,000 \times 5.786$

$PVA_{5\%,7} = \$810,040$

Calculator solution: $810,092.28

E $PVA_{10\%,5} = \$22,500 \times 3.791$

$PVA_{10\%,5} = \$85,297.50$

Calculator solution: $85,292.70

P4-20. LG 3: Personal finance: Retirement planning

Challenge

a. $FVA_{40} = \$2,000 \times (FVIFA_{10\%,40})$

$FVA_{40} = \$2,000 \times (442.593)$

$FVA_{40} = \$885,186$

Calculator solution: $885,185.11

b. $FVA_{30} = \$2,000 \times (FVIFA_{10\%,30})$

$FVA_{30} = \$2,000 \times (164.494)$

$FVA_{30} = \$328,988$

Calculator solution: $328,988.05

c. By delaying the deposits by 10 years the total opportunity cost is $556,198. This difference is due to both the lost deposits of $20,000 ($2,000 × 10yrs.) and the lost compounding of interest on all of the money for 10 years.

P4-21. LG 3: Personal finance: Value of a retirement annuity

Intermediate

$PVA = PMT \times (PVIFA_{9\%,25})$

$PVA = \$12,000 \times (9.823)$

$PVA = \$117,876.00$

Calculator solution: $117,870.96

P4-22. LG 3: Personal finance: Funding your retirement

Challenge

a. $PVA = PMT \times (PVIFA_{11\%,30})$
$PVA = \$20,000 \times (8.694)$
$PVA = \$173,880.00$
Calculator solution: $173,875.85

b. $PV = FV \times (PVIF_{9\%,20})$
$PV = \$173,880 \times (0.178)$
$PV = \$30,950.64$
Calculator solution: $31,024.82

c. Both values would be lower. In other words, a smaller sum would be needed in 20 years for the annuity and a smaller amount would have to be put away today to accumulate the needed future sum.

P4-23. LG 2, 3: Personal finance: Value of an annuity versus a single amount

Intermediate

a. $PVA_n = PMT \times (PVIFA_{i\%,n})$
$PVA_{25} = \$40,000 \times (PVIFA_{5\%,25})$
$PVA_{25} = \$40,000 \times 14.094$
$PVA_{25} = \$563,760$
Calculator solution: $563,757.78

At 5%, taking the award as an annuity is better; the present value is $563,760, compared to receiving $500,000 as a lump sum.

b. $PVA_n = \$40,000 \times (PVIFA_{7\%,25})$
$PVA_{25} = \$40,000 \times (11.654)$
$PVA_{25} = \$466,160$
Calculator solution: $466,143.33

At 7%, taking the award as a lump sum is better; the present value of the annuity is only $466,160, compared to the $500,000 lump sum payment.

c. Because the annuity is worth more than the lump sum at 5% and less at 7%, try 6%:
$PV_{25} = \$40,000 \times (PVIFA_{6\%,25})$
$PV_{25} = \$40,000 \times 12.783$
$PV_{25} = \$511,320$

The rate at which you would be indifferent is greater than 6%; about 6.25% Calculator solution: 6.24%

P4-24. LG 3: Perpetuities: $PV_n = PMT \times (PVIFA_{i\%,\infty})$

Basic

a.

Case	PV Factor
A	1 ÷ 0.08 = 12.50
B	1 ÷ 0.10 = 10.00
C	1 ÷ 0.06 = 16.67
D	1 ÷ 0.05 = 20.00

b.

$PMT \times (PVIFA_{i\%,\infty}) = PMT \times (1 \div i)$
$20,000× 12.50 = $250,000
$100,000 × 10.00 = $1,000,000
$3,000 × 16.67 = $50,000
$60,000 × 20.00 = $1,200,000

P4-25. LG 3: Personal finance: Creating an endowment

Intermediate

a. $PV = PMT \times (PVIFA_{i\%,\infty})$
$PV = (\$600 \times 3) \times (1 \div i)$
$PV = \$1,800 \times (1 \div 0.06)$
$PV = \$1,800 \times (16.67)$
$PV = \$30,006$
Calculator solution: $30,000

b. $PV = PMT \times (PVIFA_{i\%,\infty})$
$PV = (\$600 \times 3) \times (1 \div i)$
$PV = \$1,800 \times (1 \div 0.09)$
$PV = \$1,800 \times (11.11)$
$PV = \$19,998$
Calculator solution: $20,000

P4-26. LG 4: Value of a mixed stream

Challenge

a.

Cash Flow Stream	Year	Number of Years to Compound	$FV = CF \times FVIF_{12\%,n}$		Future Value
A	1	3	$ 900 × 1.405	=	$ 1,264.50
	2	2	1,000 × 1.254	=	1,254.00
	3	1	1,200 × 1.120	=	1,344.00
					$ 3,862.50
			Calculator solution:		$ 3,862.84
B	1	5	$30,000 × 1.762	=	$ 52,860.00
	2	4	25,000 × 1.574	=	39,350.00
	3	3	20,000 × 1.405	=	28,100.00
	4	2	10,000 × 1.254	=	12,540.00
	5	1	5,000 × 1.120	=	5,600.00
					$138,450.00
			Calculator solution:		$138,450.79
C	1	4	$ 1,200 × 1.574	=	$ 1,888.80
	2	3	1,200 × 1.405	=	1,686.00
	3	2	1,000 × 1.254	=	1,254.00
	4	1	1,900 × 1.120	=	2,128.00
					$ 6,956.80
			Calculator solution:		$ 6,956.54

P4-27. LG 4: Personal finance: Value of a single amount versus a mixed stream

Intermediate

a. **Lump Sum Deposit**

$FV_5 = PV \times (FVIF_{7\%,5)})$
$FV_5 = \$24,000 \times (1.403)$
$FV_5 = \$33,672.00$
Calculator solution: $33,661.24

b. **Mixed Stream of Payments**

Beginning of Year	Number of Years to Compound	$FV = CF \times FVIF_{7\%,n}$		Future Value
1	5	\$ 2,000 × 1.403	=	\$ 2,805.00
2	4	\$ 4,000 × 1.311	=	\$ 5,243.00
3	3	\$ 6,000 × 1.225	=	\$ 7,350.00
4	2	\$ 8,000 × 1.145	=	\$ 9,159.00
5	1	\$10,000 × 1.070	=	\$10,700.00
				\$35,257.00
		Calculator solution:		\$35,257.75

c. Gina should select the stream of payments over the front-end lump sum payment. Her future wealth will be higher by \$1,588.

d. **With a 10% Discount rate**

Lump Sum Deposit

$FV_5 = PV \times (FVIF_{10\%,5)})$

$FV_5 = \$24,000 \times (1.611)$

$FV_5 = \$38,664.00$

Calculator solution: \$38,652.24

b. **Mixed Stream of Payments**

Beginning of Year	Number of Years to Compound	$FV = CF \times FVIF_{10\%,n}$		Future Value
1	5	\$ 2,000 × 1.611	=	\$ 3,222.00
2	4	\$ 4,000 × 1.464	=	\$ 5,846.00
3	3	\$ 6,000 × 1.331	=	\$ 7,986.00
4	2	\$ 8,000 × 1.210	=	\$ 9,680.00
5	1	\$10,000 × 1.100	=	\$11,000.00
				\$37,734.00
		Calculator solution:		\$37,743.42

With the higher interest rate, Gina would be better off with the lump sum cash flow.

P4-28. LG 4: Value of mixed stream

Basic

Cash Flow Stream	Year	CF	×	$PVIF_{12\%,n}$	=	Present Value
A	1	–$2000	×	0.893	=	– $1,786
	2	3,000	×	0.797	=	2,391
	3	4,000	×	0.712	=	2,848
	4	6,000	×	0.636	=	3,816
	5	8,000	×	0.567	=	4,536
						$11,805
			Calculator solution:			$11,805.51
B	1	$10,000	×	0.893	=	$ 8,930
	2–5	5,000	×	2.712[a]	=	13,560
	6	7,000	×	0.507	=	3,549
						$26,039
			Calculator solution:			$26,034.58
[*]Sum of PV factors for years 2–5						
C	1–5	$10,000	×	3.605[b]		$36,050
	6–10	8,000	×	2.045[c]		16,360
						$52,410
			Calculator solution:			$52,411.34

[a]PVIFA for 12% over years 2 through 5 = (PVIFA 12%, 5 years) – (PVIFA 12%, 1 year)

[b]PVIFA for 12%, 5 years

[c](PVIFA for 12%, 10 years) – (PVIFA for 12%, 5 years)

P4-29. LG 4: PV-mixed stream

Intermediate

a.

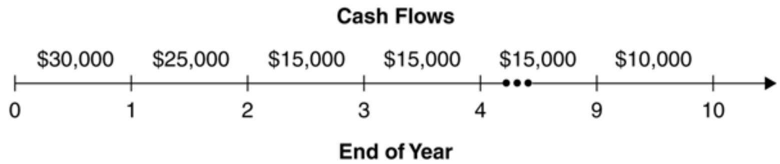
Cash Flow Stream	Year	CF	×	$PVIF_{15\%,n}$	=	Present Value
A	1	$50,000	×	0.870	=	$ 43,500
	2	40,000	×	0.756	=	30,240
	3	30,000	×	0.658	=	19,740
	4	20,000	×	0.572	=	11,440
	5	10,000	×	0.497	=	4,970
						$109,890
			Calculator solution:			$109,856.33
B	1	$10,000	×	0.870	=	$ 8,700
	2	20,000	×	0.756	=	15,120
	3	30,000	×	0.658	=	19,740
	4	40,000	×	0.572	=	22,880
	5	50,000	×	0.497	=	24,850
						$ 91,290
			Calculator solution:			$ 91,272.98

b. Cash flow Stream A, with a present value of $109,890, is higher than cash flow Stream B's present value of $91,290 because the larger cash inflows occur in A in the early years when their present value is greater, while the smaller cash flows are received further in the future.

P4-30. LG 1, 4: Value of a mixed stream

Intermediate

a.



b.

Cash Flow Stream	Year	CF	×	$PVIF_{12\%,n}$	=	Present Value
A	1	$30,000	×	0.893	=	$ 26,790
	2	25,000	×	0.797	=	19,925
	3–9	15,000	×	3.639*	=	54,585
	10	10,000	×	0.322	=	3,220
						$104,520
				Calculator solution:		$104,508.28

* The PVIF for this 7-year annuity is obtained by summing together the PVIFs of 12% for periods 3 through 9. This factor can also be calculated by taking the $PVIFA_{12\%,7}$ and multiplying by the $PVIF_{12\%,2}$. Alternatively, one could subtract $PVIFA_{12\%,2}$ from $PVIFA_{12\%,9}$.

c. Harte should accept the series of payments offer. The present value of that mixed stream of payments is greater than the $100,000 immediate payment.

P4-31. LG 5: Personal finance: Funding budget shortfalls

Intermediate

a.

Year	Budget Shortfall	×	$PVIF_{8\%,n}$	=	Present Value
1	$5,000	×	0.926	=	$ 4,630
2	4,000	×	0.857	=	3,428
3	6,000	×	0.794	=	4,764
4	10,000	×	0.735	=	7,350
5	3,000	×	0.681	=	2,043
					$22,215
			Calculator solution:		$22,214.03

A deposit of $22,215 would be needed to fund the shortfall for the pattern shown in the table.

b. An increase in the earnings rate would reduce the amount calculated in Part (a). The higher rate would lead to a larger interest being earned each year on the investment. The larger interest amounts will permit a decrease in the initial investment to obtain the same future value available for covering the shortfall.

P4-32. LG 4: Relationship between future value and present value-mixed stream

Intermediate

a. **Present Value**

Year	CF	×	$PVIF_{5\%,n}$	=	Present Value
1	$800	×	0.952	=	$ 761.60
2	900	×	0.907	=	816.30
3	1,000	×	0.864	=	864.00
4	1,500	×	0.822	=	1,233.00
5	2,000	×	0.784	=	1,568.00
					$5,242.90
			Calculator solution:		$5,243.17

b. The maximum you should pay is $5,242.90.

c. A higher 7% discount rate will cause the present value of the cash flow stream to be lower than $5,242.90.

P4-33. LG 5: Changing compounding frequency

Intermediate

a. Compounding frequency: $FV_n = PV \times FVIF_{i\%/m, n \times m}$

(1) **Annual**

12%, 5 years

$FV_5 = \$5,000 \times (1.762)$

$FV_5 = \$8,810$

Calculator solution: $8,811.71

Semiannual

12% ÷ 2 = 6%, 5 × 2 = 10 periods

$FV_5 = \$5,000 \times (1.791)$

$FV_5 = \$8,955$

Calculator solution: $8,954.24

Quarterly

12% ÷ 4 = 3%, 5 × 4 = 20 periods

$FV_5 = \$5,000\ (1.806)$

$FV_5 = \$9,030$

Calculator solution: $9,030.56

(2) **Annual**

16%, 6 years

$FV_6 = \$5,000\ (2.436)$

$FV_6 = \$12,180$

Calculator solution: $12,181.98

Semiannual

16% ÷ 2 = 8%, 6 × 2 = 12 periods

$FV_6 = \$5,000\ (2.518)$

$FV_6 = \$12,590$

Calculator solution: $12,590.85

Quarterly

16% ÷ 4 = 4%, 6 × 4 = 24 periods

$FV_6 = \$5,000\ (2.563)$

$FV_6 = \$12,815$

Calculator solution: $12,816.52

(3) **Annual**
20%, 10 years
FV_{10} = \$5,000 × (6.192)
FV_{10} = \$30,960
Calculator solution: \$30,958.68

Semiannual
20% ÷ 2 = 10%, 10 × 2 = 20 periods
FV_{10} = \$5,000 × (6.727)
FV_{10} = \$33,635
Calculator solution: \$33,637.50

Quarterly
20% ÷ 4 = 5%, 10 × 4 = 40 periods
FV_{10} = \$5,000 × (7.040)
FV_{10} = \$35,200
Calculator solution: \$35,199.94

b. Effective interest rate: $i_{eff} = (1 + i/m)^m - 1$

(1) **Annual**
$i_{eff} = (1 + 0.12/1)^1 - 1$
$i_{eff} = (1.12)^1 - 1$
$i_{eff} = (1.12) - 1$
$i_{eff} = 0.12 = 12\%$

Semiannual
$i_{eff} = (1 + 12/2)^2 - 1$
$i_{eff} = (1.06)^2 - 1$
$i_{eff} = (1.124) - 1$
$i_{eff} = 0.124 = 12.4\%$

Quarterly
$i_{eff} = (1 + 12/4)^4 - 1$
$i_{eff} = (1.03)^4 - 1$
$i_{eff} = (1.126) - 1$
$i_{eff} = 0.126 = 12.6\%$

(2) **Annual**
$i_{eff} = (1 + 0.16/1)^1 - 1$
$i_{eff} = (1.16)^1 - 1$
$i_{eff} = (1.16) - 1$
$i_{eff} = 0.16 = 16\%$

Semiannual
$i_{eff} = (1 + 0.16/2)^2 - 1$
$i_{eff} = (1.08)^2 - 1$
$i_{eff} = (1.166) - 1$
$i_{eff} = 0.166 = 16.6\%$

Quarterly
$i_{eff} = (1 + 0.16/4)^4 - 1$
$i_{eff} = (1.04)^4 - 1$
$i_{eff} = (1.170) - 1$
$i_{eff} = 0.170 = 17\%$

(3) **Annual**
$i_{eff} = (1 + 0.20/1)^1 - 1$
$i_{eff} = (1.20)^1 - 1$
$i_{eff} = (1.20) - 1$
$i_{eff} = 0.20 = 20\%$

Semiannual
$i_{eff} = (1 + 0.20/2)^2 - 1$
$i_{eff} = (1.10)^2 - 1$
$i_{eff} = (1.210) - 1$
$i_{eff} = 0.210 = 21\%$

Quarterly
$I_{eff} = (1 + 0.20/4)^4 - 1$
$I_{eff} = (1.05)^4 - 1$
$I_{eff} = (1.216) - 1$
$I_{eff} = 0.216 = 21.6\%$

P4-34. LG 5: Compounding frequency, time value, and effective annual rates

Intermediate

a. Compounding frequency: $FV_n = PV \times FVIF_{i\%,n}$

A $FV_5 = \$2,500 \times (FVIF_{3\%,10})$
$FV_5 = \$2,500 \times (1.344)$
$FV_5 = \$3,360$
Calculator solution: $3,359.79

B $FV_3 = \$50,000 \times (FVIF_{2\%,18})$
$FV_3 = \$50,000 \times (1.428)$
$FV_3 = \$71,400$
Calculator solution: $71,412.31

C $FV_{10} = \$1,000 \times (FVIF_{5\%,10})$
$FV_{10} = \$1,000 \times (1.629)$
$FV_{10} = \$16,290$
Calculator solution: $1,628.89

D $FV_6 = \$20,000 \times (FVIF_{4\%,24})$
$FV_6 = \$20,000 \times (2.563)$
$FV_6 = \$51,260$
Calculator solution: $51,266.08

b. Effective interest rate: $i_{eff\,=}(1 + i\%/m)^m - 1$

A $i_{eff} = (1 + 0.06/2)^2 - 1$
$i_{eff} = (1 + 0.03)^2 - 1$
$i_{eff} = (1.061) - 1$
$i_{eff} = 0.061 = 06.1\%$

B $i_{eff} = (1 + 0.12/6)^6 - 1$
$i_{eff} = (1 + 0.02)^6 - 1$
$i_{eff} = (1.126) - 1$
$i_{eff} = 0.126 = 12.6\%$

C $i_{eff} = (1 + 0.05/1)^1 - 1$
$i_{eff} = (1 + 0.05)^1 - 1$
$i_{eff} = (1.05) - 1$
$i_{eff} = 0.05 = 5\%$

D $i_{eff} = (1 + 0.16/4)^4 - 1$
$i_{eff} = (1 + 0.04)^4 - 1$
$i_{eff} = (1.170) - 1$
$i_{eff} = 0.17 = 17\%$

c. The effective rates of interest rise relative to the stated nominal rate with increasing compounding frequency.

P4-35. LG 5: Continuous compounding: $FV_{cont.} = PV \times e^x$ ($e = 2.7183$)

Intermediate

A $FV_{cont.} = \$1,000 \times e^{0.18} = \$1,197.22$
B $FV_{cont.} = \$\ 600 \times e^{1} = \$1,630.97$
C $FV_{cont.} = \$4,000 \times e^{0.56} = \$7,002.69$
D $FV_{cont.} = \$2,500 \times e^{0.48} = \$4,040.19$

Note: If calculator doesn't have e^x key, use y^x key, substituting 2.7183 for y.

P4-36. LG 5: Personal finance: Compounding frequency and time value

Challenge

a. (1) $FV_{10} = \$2,000 \times (FVIF_{8\%,10})$
$FV_{10} = \$2,000 \times (2.159)$
$FV_{10} = \$4,318$
Calculator solution: $4,317.85

(2) $FV_{10} = \$2,000 \times (FVIF_{4\%,20})$
$FV_{10} = \$2,000 \times (2.191)$
$FV_{10} = \$4,382$
Calculator solution: $4,382.25

(3) $FV_{10} = \$2,000 \times (FVIF_{0.022\%,3650})$
$FV_{10} = \$2,000 \times (2.232)$
$FV_{10} = \$4,464$
Calculator solution: $4,450.69

(4) $FV_{10} = \$2,000 \times (e^{0.8})$
$FV_{10} = \$2,000 \times (2.226)$
$FV_{10} = \$4,452$
Calculator solution: $4,451.08

b. (1) $i_{eff} = (1 + 0.08/1)^1 - 1$
$i_{eff} = (1 + 0.08)^1 - 1$
$i_{eff} = (1.08) - 1$
$i_{eff} = 0.08 = 8\%$

(2) $i_{eff} = (1 + 0.08/2)^2 - 1$
$i_{eff} = (1 + 0.04)^2 - 1$
$i_{eff} = (1.082) - 1$
$i_{eff} = 0.082 = 8.2\%$

(3) $i_{eff} = (1 + 0.08/365)^{365} - 1$
$i_{eff} = (1 + 0.00022)^{365} - 1$
$i_{eff} = (1.0833) - 1$
$i_{eff} = 0.0833 = 8.33\%$

(4) $i_{eff} = (e^k - 1)$
$i_{eff} = (e^{0.08} - 1)$
$i_{eff} = (1.0833 - 1)$
$i_{eff} = 0.0833 = 8.33\%$

c. Compounding continuously will result in $134 more dollars at the end of the 10 year period than compounding annually.

d. The more frequent the compounding the larger the future value. This result is shown in part a by the fact that the future value becomes larger as the compounding period moves from annually to continuously. Since the future value is larger for a given fixed amount invested, the effective return also increases directly with the frequency of compounding. In Part **b** we see this fact as the effective rate moved from 8% to 8.33% as compounding frequency moved from annually to continuously.

P4-37. LG 5: Personal finance: Comparing compounding periods

Challenge

a. $FV_n = PV \times FVIF_{i\%,n}$

(1) **Annually:** $FV = PV \times FVIF_{12\%,2} = \$15,000 \times (1.254) = \$18,810$
Calculator solution: $18,816

(2) **Quarterly:** $FV = PV \times FVIF_{3\%,8} = \$15,000 \times (1.267) = \$19,005$
Calculator solution: $19,001.55

(3) **Monthly:** $FV = PV \times FVIF_{1\%,24} = \$15,000 \times (1.270) = \$19,050$
Calculator solution: $19,046.02

(4) **Continuously:** $FV_{cont.} = PV \times e^{x\,t}$
$FV = PV \times 2.7183^{0.24} = \$15,000 \times 1.27125 = \$19,068.77$
Calculator solution: $19,068.74

b. The future value of the deposit increases from $18,810 with annual compounding to $19,068.77 with continuous compounding, demonstrating that future value increases as compounding frequency increases.

c. The maximum future value for this deposit is $19,068.77, resulting from continuous compounding, which assumes compounding at every possible interval.

P4-38. LG 3, 5: Personal finance: Annuities and compounding: $FVA_n = PMT \times (FVIFA_{i\%,n})$

Intermediate

a. (1) **Annual**

$FVA_{10} = \$300 \times (FVIFA_{8\%,10})$

$FVA_{10} = \$300 \times (14.487)$

$FVA_{10} = \$4,346.10$

Calculator solution: $4,345.97

(2) **Semiannual**

$FVA_{10} = \$150 \times (FVIFA_{4\%,20})$

$FVA_{10} = \$150 \times (29.778)$

$FVA_{10} = \$4,466.70$

Calculator solution: $4,466.71

(3) **Quarterly**

$FVA_{10} = \$75 \times .(FVIFA_{2\%,40})$

$FVA_{10} = \$75 \times (60.402)$

$FVA_{10} = \$4,530.15$

Calculator solution: $4,530.15

b. The sooner a deposit is made the sooner the funds will be available to earn interest and contribute to compounding. Thus, the sooner the deposit and the more frequent the compounding, the larger the future sum will be.

P4-39. LG 6: Deposits to accumulate growing future sum: $PMT = \frac{FVA_n}{FVIFA_{i\%,n}}$

Basic

Case	Terms	Calculation	Payment
A	12%, 3 yrs.	PMT = $5,000 ÷ 3.374 =	$1,481.92
		Calculator solution:	$1,481.74
B	7%, 20 yrs.	PMT = $100,000 ÷ 40.995 =	$2,439.32
		Calculator solution:	$2,439.29
C	10%, 8 yrs.	PMT = $30,000 ÷ 11.436 =	$2,623.29
		Calculator solution:	$2,623.32
D	8%, 12 yrs.	PMT = $15,000 ÷ 18.977 =	$ 790.43
		Calculator solution:	$ 790.43

P4-40. LG 6: Personal finance: Creating a retirement fund

Intermediate

a. $PMT = FVA_{42} \div (FVIFA_{8\%,42})$

$PMT = \$220,000 \div (304.244)$

$PMT = \$723.10$

Calculator solution: $723.10

b. $FVA_{42} = PMT \times (FVIFA_{8\%,42})$

$FVA_{42} = \$600 \times (304.244)$

$FVA_{42} = \$182,546.40$

Calculator solution: $182,546.11

P4-41. LG 6: Personal finance: Accumulating a growing future sum

Intermediate

$FV_n = PV \times (FVIF_{i\%,n})$

$FV_{20} = \$185{,}000 \times (FVIF_{6\%,20})$

$FV_{20} = \$185{,}000 \times (3.207)$

$FV_{20} = \$593{,}295$ = Future value of retirement home in 20 years.

Calculator solution: $593,320.06

$PMT = FV \div (FVIFA_{i\%,n})$

$PMT = \$593{,}295 \div (FVIFA_{10\%,20})$

$PMT = \$593{,}295 \div (57.274)$

PMT = $10,358.89

Calculator solution: $10,359.15 = annual payment required.

P4-42. LG 3, 6: Personal finance: Deposits to create a perpetuity

Intermediate

a. Present value of a perpetuity $= PMT \times (1 \div i)$

$= \$6{,}000 \times (1 \div 0.10)$

$= \$6{,}000 \times 10$

$= \$60{,}000$

b. $PMT = FVA \div (FVIFA_{10\%,10})$

$PMT = \$60{,}000 \div (15.937)$

PMT = $3,764.82

Calculator solution: $3,764.72

P4-43. LG 2, 3, 6: Personal finance: Inflation, time value, and annual deposits

Challenge

a. $FV_n = PV \times (FVIF_{i\%,n})$

$FV_{20} = \$200{,}000 \times (FVIF_{5\%,25})$

$FV_{20} = \$200{,}000 \times (3.386)$

$FV_{20} = \$677{,}200$ = Future value of retirement home in 25 years.

Calculator solution: $677,270.99

b. $PMT = FV \div (FVIFA_{i\%,n})$

$PMT = \$677{,}270.99 \div (FVIFA_{9\%,25})$

$PMT = \$677{,}270.99 \div (84.699)$

PMT = $7,995.37

Calculator solution: $7,996.03 = annual payment required.

P4-44. LG 6: Loan payment: $PMT = \frac{PVA}{PVIFA_{i\%,n}}$

Basic

Loan

A $PMT = \$12,000 \div (PVIFA_{8\%,3})$
$PMT = \$12,000 \div 2.577$
$PMT = \$4,656.58$
Calculator solution: $4,656.40

B $PMT = \$60,000 \div (PVIFA_{12\%,10})$
$PMT = \$60,000 \div 5.650$
$PMT = \$10,619.47$
Calculator solution: $10,619.05

C $PMT = \$75,000 \div (PVIFA_{10\%,30})$
$PMT = \$75,000 \div 9.427$
$PMT = \$7,955.87$
Calculator solution: $7,955.94

D $PMT = \$4,000 \div (PVIFA_{15\%,5})$
$PMT = \$4,000 \div 3.352$
$PMT = \$1,193.32$
Calculator solution: $1,193.26

P4-45. LG 6: Personal finance: Loan amortization schedule

Intermediate

a. $PMT = \$15,000 \div (PVIFA_{14\%,3})$
$PMT = \$15,000 \div 2.322$
$PMT = \$6,459.95$
Calculator solution: $6,460.97

b.

End of Year	**Loan Payment**	**Beginning of Year Principal**	**Payments**		**End of Year Principal**
			Interest	**Principal**	
1	$6,459.95	$15,000.00	$2,100.00	$4,359.95	$10,640.05
2	6,459.95	10,640.05	1,489.61	4,970.34	5,669.71
3	6,459.95	5,669.71	793.76	5,666.19	0

(The difference in the last year's beginning and ending principal is due to rounding.)

c. Through annual end-of-the-year payments, the principal balance of the loan is declining, causing less interest to be accrued on the balance.

P4-46. LG 6: Loan interest deductions

Challenge

a. $PMT = \$10,000 \div (PVIFA_{13\%,3})$
$PMT = \$10,000 \div (2.361)$
$PMT = \$4,235.49$
Calculator solution: $4,235.22

b.

End of Year	**Loan Payment**	**Beginning of Year Principal**	**Payments**		**End of Year Principal**
			Interest	**Principal**	
1	$4,235.49	$10,000.00	$1,300.00	$2,935.49	$7,064.51
2	4,235.49	7,064.51	918.39	3,317.10	3,747.41
3	4,235.49	3,747.41	487.16	3,748.33	0

(The difference in the last year's beginning and ending principal is due to rounding.)

P4-47. LG 6: Personal finance: Monthly loan payments

Challenge

a. PMT = \$4,000 ÷ ($PVIFA_{1\%,24}$)
PMT = \$4,000 ÷ (21.243)
PMT = \$188.28
Calculator solution: \$188.29

b. PMT = \$4,000 ÷ ($PVIFA_{0.75\%,24}$)
PMT = \$4,000 ÷ (21.889)
PMT = \$182.74
Calculator solution: \$182.74

P4-48. LG 6: Growth rates

Basic

a. $PV = FV_n \times PVIF_{i\%,n}$

Case

A
$PV = FV_4 \times PVIF_{k\%,4yrs.}$
$\$500 = \$800 \times PVIF_{k\%,4yrs}$
$0.625 = PVIF_{k\%,4yrs}$
$12\% < k < 13\%$
Calculator solution: 12.47%

B
$PV = FV_9 \times PVIF_{i\%,9yrs.}$
$\$1,500 = \$2,280 \times PVIF_{k\%,9yrs.}$
$0.658 = PVIF_{k\%,9yrs.}$
$4\% < k < 5\%$
Calculator solution: 4.76%

C
$PV = FV_6 \times PVIF_{i\%,6}$
$\$2,500 = \$2,900 \times PVIF_{k\%,6\ yrs.}$
$0.862 = PVIF_{k\%,6yrs.}$
$2\% < k < 3\%$
Calculator solution: 2.50%

b.

Case

A Same as in **a**
B Same as in **a**
C Same as in **a**

c. The growth rate and the interest rate should be equal, since they represent the same thing.

P4-49. LG 6: Personal finance: Rate of return: $PV_n = FV_n \times (PVIF_{i\%,n})$

Intermediate

a. $PV = \$2,000 \times (PVIF_{i\%,3yrs.})$
$\$1,500 = \$2,000 \times (PVIF_{i\%,3\ yrs.})$
$0.75 = PVIF_{i\%,3\ yrs.}$
$10\% < i < 11\%$
Calculator solution: 10.06%

b. Mr. Singh should accept the investment that will return \$2,000 because it has a higher return for the same amount of risk.

P4-50. LG 6: Personal finance: Rate of return and investment choice

Intermediate

a. **A**

$PV = \$8,400 \times (PVIF_{i\%,6yrs.})$

$\$5,000 = \$8,400 \times (PVIF_{i\%,6\ yrs.})$

$0.595 = PVIF_{i\%,6\ yrs.}$

$9\% < i < 10\%$

Calculator solution: 9.03%

B

$PV = \$15,900 \times (PVIF_{i\%,15yrs.})$

$\$5,000 = \$15,900 \times (PVIF_{i\%,15yrs.})$

$0.314 = PVIF_{i\%,15yrs.}$

$8\% < i < 9\%$

Calculator solution: 8.02%

C

$PV = \$7,600 \times (PVIF_{i\%,4yrs.})$

$\$5,000 = \$7,600 \times (PVIF_{i\%,4\ yrs.})$

$0.658 = PVIF_{i\%,4\ yrs.}$

$11\% < i < 12\%$

Calculator solution: 11.04%

D

$PV = \$13,000 \times (PVIF_{i\%,10\ yrs.})$

$\$5,000 = \$13,000 \times (PVIF_{i\%,10\ yrs.})$

$0.385 = PVIF_{i\%,10\ yrs.}$

$10\% < i < 11\%$

Calculator solution: 10.03%

b. Investment C provides the highest return of the four alternatives. Assuming equal risk for the alternatives, Clare should choose C.

P4-51. LG 6: Rate of return-annuity: $PVA_n = PMT \times (PVIFA_{i\%,n})$

Basic

$\$10,606 = \$2,000 \times (PVIFA_{i\%,10\ yrs.})$

$5.303 = PVIFA_{i\%,10\ yrs.}$

$13\% < i < 14\%$

Calculator solution: 13.58%

P4-52. LG 6: Personal finance: Choosing the best annuity: $PVA_n = PMT \times (PVIFA_{i\%,n})$

Intermediate

a. **Annuity A**

$\$30,000 = \$3,100 \times (PVIFA_{i\%,20\ yrs.})$

$9.677 = PVIFA_{i\%,20\ yrs.}$

$8\% < i < 9\%$

Calculator solution: 8.19%

Annuity B

$\$25,000 = \$3,900 \times (PVIFA_{i\%,10\ yrs.})$

$6.410 = PVIFA_{i\%,10\ yrs.}$

$9\% < i < 10\%$

Calculator solution: 9.03%

Annuity C

$\$40,000 = \$4,200 \times (PVIFA_{i\%,15\ yrs.})$

$9.524 = PVFA_{i\%,15\ yrs.}$

$6\% < i < 7\%$

Calculator solution: 6.3%

Annuity D

$\$35,000 = \$4,000 \times (PVIFA_{i\%,12\ yrs.})$

$8.75 = PVIFA_{i\%,12\ yrs.}$

$5\% < i < 6\%$

Calculator solution: 5.23%

b. Annuity B gives the highest rate of return at 9% and would be the one selected based upon Raina's criteria.

P4-53. LG 6: Personal finance: Interest rate for an annuity
Challenge

a. **Defendants interest rate assumption**

$\$2{,}000{,}000 = \$156{,}000 \times (PVIFA_{i\%,25\text{ yrs.}})$

$12.821 = PVFA_{i\%,25\text{ yrs.}}$

$5\% < i < 6\%$

Calculator solution: 5.97%

b. **Prosecution interest rate assumption**

$\$2{,}000{,}000 = \$255{,}000 \times (PVIFA_{i\%,25\text{ yrs.}})$

$7.843 = PVFA_{i\%,25\text{ yrs.}}$

$i = 12\%$

Calculator solution: 12.0%

c. $\$2{,}000{,}000 = PMT \times (PVIFA_{9\%,25\text{yrs.}})$

$\$2{,}000{,}000 = PMT\ (9.823)$

$PMT = \$203{,}603.79$

Calculator solution: $203,612.50

P4-54. LG 6: Personal finance: Loan rates of interest: $PVA_n = PMT \times (PVIFA_{i\%,n})$
Intermediate

a. **Loan A**

$\$5{,}000 = \$1{,}352.81 \times (PVIFA_{i\%,5\text{ yrs.}})$

$3.696 = PVIFA_{i\%,5\text{ yrs.}}$

$i = 11\%$

Loan B

$\$5{,}000 = \$1{,}543.21 \times (PVIFA_{i\%,4\text{ yrs.}})$

$3.24 = PVIFA_{i\%,4\text{ yrs.}}$

$i = 9\%$

Loan C

$\$5{,}000 = \$2{,}010.45 \times (PVIFA_{i\%,3\text{ yrs.}})$

$2.487 = PVIFA_{k\%,3\text{ yrs.}}$

$i = 10\%$

Calculator solutions are identical.

b. Mr. Fleming should choose Loan B, which has the lowest interest rate.

P4-55. LG 6: Number of years to equal future amount
Intermediate

A

$FV = PV \times (FVIF_{7\%,n\text{ yrs.}})$

$\$1{,}000 = \$300 \times (FVIF_{7\%,n\text{ yrs.}})$

$3.333 = FVIF_{7\%,n\text{ yrs.}}$

$17 < n < 18$

Calculator solution: 17.79 years

B

$FV = \$12{,}000 \times (FVIF_{5\%,n\text{ yrs.}})$

$\$15{,}000 = \$12{,}000 \times (FVIF_{5\%,n\text{ yrs.}})$

$1.250 = FVIF_{5\%,n\text{ yrs.}}$

$4 < n < 5$

Calculator solution: 4.573 years

C

$FV = PV \times (FVIF_{10\%,n\text{ yrs.}})$

$\$20{,}000 = \$9{,}000 \times (FVIF_{10\%,n\text{ yrs.}})$

$2.222 = FVIF_{10\%,n\text{ yrs.}}$

$8 < n < 9$

Calculator solution: 8.38 years

D

$FV = \$100 \times (FVIF_{9\%,n\text{ yrs.}})$

$\$500 = \$100 \times (FVIF_{9\%,n\text{ yrs.}})$

$5.00 = FVIF_{9\%,n\text{ yrs.}}$

$18 < n < 19$

Calculator solution: 18.68 years

E $FV = PV \times (FVIF_{15\%,n\ yrs.})$

$\$30{,}000 = \$7{,}500 \times (FVIF_{15\%,n\ yrs.})$

$4.000 = FVIF_{15\%,n\ yrs.}$

$9 < n < 10$

Calculator solution: 9.92 years

P4-56. LG 6: Personal finance: Time to accumulate a given sum

Intermediate

a. $20{,}000 = \$10{,}000 \times (FVIF_{10\%,n\ yrs.})$

$2.000 = FVIF_{10\%,n\ yrs.}$

$7 < n < 8$

Calculator solution: 7.27 years

b. $20{,}000 = \$10{,}000 \times (FVIF_{7\%,n\ yrs.})$

$2.000 = FVIF_{7\%,n\ yrs.}$

$10 < n < 11$

Calculator solution: 10.24 years

c. $20{,}000 = \$10{,}000 \times (FVIF_{12\%,n\ yrs.})$

$2.000 = FVIF_{12\%,n\ yrs.}$

$6 < n < 7$

Calculator solution: 6.12 years

d. The higher the rate of interest the less time is required to accumulate a given future sum.

P4-57. LG 6: Number of years to provide a given return

Intermediate

A $PVA = PMT \times (PVIFA_{11\%,n\ yrs.})$

$\$1{,}000 = \$250 \times (PVIFA_{11\%,n\ yrs.})$

$4.000 = PVIFA_{11\%,n\ yrs.}$

$5 < n < 6$

Calculator solution: 5.56 years

B $PVA = PMT \times (PVIFA_{15\%,n\ yrs.})$

$\$150{,}000 = \$30{,}000 \times (PVIFA_{15\%,n\ yrs.})$

$5.000 = PVIFA_{15\%,n\ yrs.}$

$9 < n < 10$

Calculator solution: 9.92 years

C $PVA = PMT \times (PVIFA_{10\%,n\ yrs.})$

$\$80{,}000 = \$10{,}000 \times (PVIFA_{10\%,n\ yrs.})$

$8 = PVIFA_{10\%,n\ yrs.}$

$16 < n < 17$

Calculator solution: 16.89 years

D $PVA = PMT \times (PVIFA_{9\%,n\ yrs.})$

$\$600 = \$275 \times (PVIFA_{9\%,n\ yrs.})$

$2.182 = PVIFA_{9\%,n\ yrs.}$

$2 < n < 3$

Calculator solution: 2.54 years

E $PVA = PMT \times (PVIFA_{6\%,n\ yrs.})$

$\$17{,}000 = \$3{,}500 \times (PVIFA_{6\%,n\ yrs.})$

$4.857 = PVIFA_{6\%,n\ yrs.}$

$5 < n < 6$

Calculator solution: 5.91 years

P4-58. LG 6: Personal finance: Time to repay installment loan

Intermediate

a. $\$14{,}000 = \$2{,}450 \times (PVIFA_{12\%,n\ yrs.})$

$5.714 = PVIFA_{12\%,n\ yrs.}$

$10 < n < 11$

Calculator solution: 10.21 years

b. $\$14,000 = \$2,450 \times (PVIFA_{9\%,n\ yrs.})$

$5.714 = PVIFA_{9\%,n\ yrs.}$

$8 < n < 9$

Calculator solution: 8.38 years

c. $\$14,000 = \$2,450 \times (PVIFA_{15\%,n\ yrs.})$

$5.714 = PVIFA_{15\%,n\ yrs.}$

$13 < n < 14$

Calculator solution: 13.92 years

d. The higher the interest rate the greater the number of time periods needed to repay the loan fully.

P4-59. Ethics problem

Intermediate

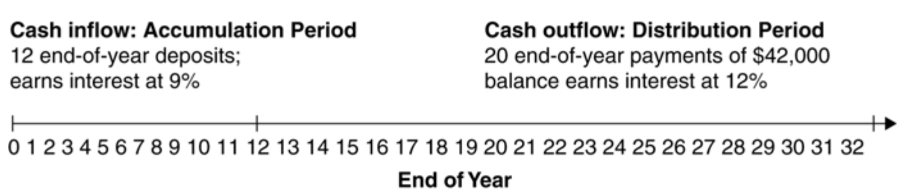
This is a tough issue. Even back in the Middle Ages, scholars debated the idea of a "just price." The ethical debate hinges on (1) the basis for usury laws, (2) whether full disclosure is made of the true cost of the advance, and (3) whether customers understand the disclosures. Usury laws are premised on the notion that there is such a thing as an interest rate (price of credit) that is "too high." A centuries-old fairness notion guides us into not taking advantage of someone in duress or facing an emergency situation. One must ask, too, why there are not market-supplied credit sources for borrowers, which would charge lower interest rates and receive an acceptable risk-adjusted return. On issues #2 and #3, there is no assurance that borrowers comprehend or are given adequate disclosures. See the box for the key ethics issues on which to refocus attention (some would view the objection cited as a smokescreen to take our attention off the true ethical issues in this credit offer).

■ Case

Finding Jill Moran's Retirement Annuity

Chapter 4's case challenges the student to apply present value and future value techniques to a real-world situation. The first step in solving this case is to determine the total amount Sunrise Industries needs to accumulate until Ms. Moran retires, remembering to take into account the interest that will be earned during the 20-year payout period. Once that is calculated, the annual amount to be deposited can be determined.

1.



2. Total amount to accumulate by end of year 12

$PV_n = PMT \times (PVIFA_{i\%,n})$

$PV_{20} = \$42,000 \times (PVIFA_{12\%,20})$

$PV_{20} = \$42,000 \times 7.469$

$PV_{20} = \$313,698$

Calculator solution: $313,716.63

3. End-of-year deposits, 9% interest: $\text{PMT} = \dfrac{\text{FVA}_n}{\text{FVIFA}_{i\%,\,n}}$

   PMT = $313,698 ÷ ($\text{FVIFA}_{9\%,12\text{ yrs.}}$)

   PMT = $313,698 ÷ 20.141

   PMT = $15,575.10

   Calculator solution: $15,576.23

   Sunrise Industries must make a $15,575.10 annual end-of-year deposit in years 1–12 in order to provide Ms. Moran a retirement annuity of $42,000 per year in years 13 to 32.

4. End-of-year deposits, 10% interest

   PMT = $313,698 ÷ ($\text{FVIFA}_{10\%,12\text{ yrs.}}$)

   PMT = $313,698 ÷ 21.384

   PMT = $14,669.75

   Calculator solution: $14,669.56

   The corporation must make a $14,669.75 annual end-of-year deposit in years 1–12 in order to provide Ms. Moran a retirement annuity of $42,000 per year in years 13 to 32.

5. Initial deposit if annuity is a perpetuity and initial deposit earns 9%:

   $\text{PV}_{\text{perp}} = \text{PMT} \times (1 \div i)$

   PV_{perp} = $42,000 × (1 ÷ 0.12)

   PV_{perp} = $42,000 × 8.333

   PV_{perp} = $349,986

   Calculator solution: $350,000

   End-of-year deposit:

   $\text{PMT} = \text{FVA}_n \div (\text{FVIFA}_{i\%,n})$

   PMT = $349,986 ÷ ($\text{FVIFA}_{9\%,12\text{ yrs.}}$)

   PMT = $349,986 ÷ 20.141

   PMT = $17,376.79

   Calculator solution: $17,377.73

■ Spreadsheet Exercise

The answer to Chapter 4’s Uma Corporation spreadsheet problem is located in the Instructor’s Resource Center at *www.prenhall.com/irc*.

■ A Note on Web Exercises

A series of chapter-relevant assignments requiring Internet access can be found at the book’s Companion Website at *http://www.prenhall.com/gitman*. In the course of completing the assignments students access information about a firm, its industry, and the macro economy, and conduct analyses consistent with those found in each respective chapter.