Chapter 2

Factors: How Time and Interest Affect Money

Solutions to Problems

2.1 1. (F/P,8%25) = 6.8485; 2. (P/A,3%,8) = 7.0197; 3. (P/G,9%,20) = 61.7770;
4. (F/A,15%,18) = 75.8364; 5. (A/P,30%,15) = 0.30598

2.2 P = 140,000(F/P,7%,4)
=140,000(1.3108)
= $183,512

2.3 F = 200,000(F/P,10%,3)
= 200,000(1.3310)
= $266,200

2.4 P = 600,000(P/F,12%,4)
= 600,000(0.6355)
= $381,300

2.5 (a) A = 225,000(A/P,15%,4)
= 225,000(0.35027)
= $78,811

(b) Recall amount = 78,811/0.10
= $788,110 per year

2.6 F = 150,000(F/P,18%,7)
= 150,000(3.1855)
= $477,825

2.7 P = 75(P/F,18%,2)
= 75(0.7182)
= $53.865 million

2.8 P = 100,000((P/F,12%,2)
= 100,000(0.7972)
= $79,720

2.9 F = 1,700,000(F/P,18%,1)
= 1,700,000(1.18)
= $2,006,000

2.10 P = 162,000(P/F,12%,6)
= 162,000(0.5066)
= $82,069

2.11 P = 125,000(P/F,14%,5)
= 125,000(0.5149)
= $ 64,925

2.12 P = 9000(P/F,10%,2) + 8000(P/F,10%,3) + 5000(P/F,10%,5)
= 9000(0.8264) + 8000(0.7513) + 5000(0.6209)
= $16,553

2.13 P = 1,250,000(0.10)(P/F,8%,2) + 500,000(0.10)(P/F,8%,5)
= 125,000(0.8573) + 50,000(0.6806)
= $141,193

2.14 F = 65,000(F/P,4%,5)
= 65,000(1.2167)
= $79,086

2.15 P = 75,000(P/A,20%,3)
= 75,000(2.1065)
= $157,988

2.16 A = 1.8(A/P,12%,6)
= 1.8(0.24323)
= $437,814

2.17 A = 3.4(A/P,20%,8)
= 3.4(0.26061)
= $886,074

2.18 P = (280,000-90,000)(P/A,10%,5)
= 190,000(3.7908)
= $720,252

2.19 P = 75,000(P/A,15%,5)
= 75,000(3.3522)
= $251,415

2.20 F = (458-360)(20,000)(0.90)(F/A,8%,5)
= 1,764,000(5.8666)
= $10,348,682

2.21 P = 200,000((P/A,10%,5)
= 200,000(3.7908)
= $758,160

2.22 P = 2000(P/A,8%,35)
= 2000(11.6546)
= $23,309

2.23 A = 250,000(A/F,9%,3)
= 250,000(0.30505)
= $76,263

2.24 F = (100,000 + 125,000)(F/A,15%,3)
= 225,000(3.4725)
= $781,313

2.25 (a) 1. Interpolate between n = 32 and n = 34:
1/2 = x/0.0014
x = 0.0007
(P/F,18%,33) = 0.0050 – 0.0007
= 0.0043

2. Interpolate between n = 50 and n = 55:
4/5 = x/0.0654
x = 0.05232
(A/G,12%,54) = 8.1597 + 0.05232
= 8.2120

(b) 1. $(P/F,18\%,33) = 1/(1+0.18)^{33}$
= 0.0042

2. $(A/G,12\%,54) = \{(1/0.12) – 54/[(1+0.12)^{54} –1\}$
= 8.2143

2.26 (a) 1. Interpolate between i = 18% and i = 20% at n = 20:
1/2 = x/40.06
x = 20.03
(F/A,19%,20) = 146.6280 + 20.03
=166.658

2. Interpolate between i = 25% and i = 30% at n = 15:
1/5 = x/0.5911
x = 0.11822
(P/A,26%,15) = 3.8593 – 0.11822
= 3.7411

(b) 1. $(F/A,19\%,20) = [(1 + 0.19)^{20} - 0.19]/0.19$
$= 169.6811$

2. $(P/A,26\%,15) = [(1 + 0.26)^{15} - 1]/[0.26(1 + 0.26)^{15}]$
$= 3.7261$

2.27 (a) G = \$200 (b) CF_8 = \$1600 (c) n = 10

2.28 (a) G = \$5 million (b) CF_6 = \$6030 million (c) n = 12

2.29 (a) G = \$100 (b) $CF_5 = 900 - 100(5) = \$400$

2.30 $300,000 = A + 10,000(A/G,10\%,5)$
$300,000 = A + 10,000(1.8101)$
$A = \$281,899$

2.31 (a) $CF_3 = 280,000 - 2(50,000)$
$= \$180,000$
(b) $A = 280,000 - 50,000(A/G,12\%,5)$
$= 280,000 - 50,000(1.7746)$
$= \$191,270$

2.32 (a) $CF_3 = 4000 + 2(1000)$
$= \$6000$
(b) $P = 4000(P/A,10\%,5) + 1000(P/G,10\%,5)$
$= 4000(3.7908) + 1000(6.8618)$
$= \$22,025$

2.33 $P = 150,000(P/A,15\%,8) + 10,000(P/G,15\%,8)$
$= 150,000(4.4873) + 10,000(12.4807)$
$= \$797,902$

2.34 $A = 14,000 + 1500(A/G,12\%,4)$
$= 14,000 + 1500(1.3589)$
$= \$16,038$

2.35 (a) Cost = 2000/0.2
$= \$10,000$
(b) $A = 2000 + 250(A/G,18\%,5)$
$= 2000 + 250(1.6728)$
$= \$2418$

2.36 Convert future to present and then solve for G using P/G factor:

$6000(P/F,15\%,4) = 2000(P/A,15\%,4) - G(P/G,15\%,4)$

$6000(0.5718) = 2000(2.8550) - G(3.7864)$

$G = \$601.94$

2.37 $50 = 6(P/A,12\%,6) + G(P/G,12\%,6)$

$50 = 6(4.1114) + G(8.9302)$

$G = \$2{,}836{,}622$

2.38 $A = [4 + 0.5(A/G,16\%,5)] - [1 - 0.1(A/G,16\%,5)$

$= [4 + 0.5(1.7060)] - [1 - 0.1(1.7060)]$

$= \$4{,}023{,}600$

2.39 For n = 1: $\{1 - [(1+0.04)^1/(1+0.10)^1\}]\}/(0.10 - 0.04) = 0.9091$

For n = 2: $\{1 - [(1+0.04)^2/(1+0.10)^2\}]\}/(0.10 - 0.04) = 1.7686$

For n = 3: $\{1 - [(1+0.04)^3/(1+0.10)^3\}]\}/(0.10 - 0.04) = 2.5812$

2.40 For g = i, $P = 60{,}000(0.1)[15/(1 + 0.04)]$

$= \$86{,}538$

2.41 $P = 25{,}000\{1 - [(1+0.06)^3/(1+0.15)^3\}]\}/(0.15 - 0.06)$

$= \$60{,}247$

2.42 Find P and then convert to A.

$P = 5{,}000{,}000(0.01)\{1 - [(1+0.20)^5/(1+0.10)^5\}]\}/(0.10 - 0.20)$

$= 50{,}000\{5.4505\}$

$= \$272{,}525$

$A = 272{,}525(A/P,10\%,5)$

$= 272{,}525(0.26380)$

$= \$71{,}892$

2.43 Find P and then convert to F.

$P = 2000\{1 - [(1+0.10)^7/(1+0.15)^7\}]\}/(0.15 - 0.10)$

$= 2000(5.3481)$

$= \$10{,}696$

$F = 10{,}696(F/P,15\%,7)$

$= 10{,}696(2.6600)$

$= \$28{,}452$

2.44 First convert future worth to P, then use P_g equation to find A.

$P = 80{,}000(P/F,15\%,10)$

$= 80{,}000(0.2472)$

$= \$19{,}776$

$19{,}776 = A\{1 - [(1+0.09)^{10}/(1+0.15)^{10}\}]\}/(0.15 - 0.09)$
$19{,}776 = A\{6.9137\}$
$A = \$2860$

2.45 Find A in year 1 and then find next value.
$900{,}000 = A\{1 - [(1+0.05)^{5}/(1+0.15)^{5}\}]\}/(0.15 - 0.05)$
$900{,}000 = A\{3.6546\}$
$A = \$246{,}263$ in year 1
Cost in year 2 = 246,263(1.05)
= \$258,576

2.46 g = i: P = 1000[20/(1 + 0.10)]
= 1000[18.1818]
= \$18,182

2.47 Find P and then convert to F.
$P = 3000\{1 - [(1+0.05)^{4}/(1+0.08)^{4}\}]\}/(0.08 - 0.05)$
= 3000{3.5522}
= \$10,657

F = 10,657(F/P,8%,4)
= 10,657(1.3605)
= \$14,498

2.48 Decrease deposit in year 4 by 5% per year for three years to get back to year 1.
First deposit = $1250/(1 + 0.05)^3$
= \$1079.80

2.49 Simple: Total interest = (0.12)(15) = 180%
Compound: $1.8 = (1 + i)^{15}$
i = 4.0%

2.50 Profit/year = 6(3000)/0.05 = \$360,000
1,200,000 = 360,000(P/A,i,10)
(P/A,i,10) = 3.3333
i = 27.3% (Excel)

2.51 2,400,000 = 760,000(P/A,i,5)
(P/A,i,5) = 3.15789
i = 17.6% (Excel)

2.52 1,000,000 = 600,000(F/P,i,5)
(F/P,i,5) = 1.6667
i = 10.8% (Excel)

2.53 125,000 = (520,000 – 470,000)(P/A,i,4)
(P/A,i,4) = 2.5000
i = 21.9% (Excel)

2.54 400,000 = 320,000 + 50,000(A/G,i,5)
(A/G,i,5) = 1.6000
Interpolate between i = 22% and i = 24%
i = 22.6%

2.55 85,000 = 30,000(P/A,i,5) + 8,000(P/G,i,5)
Solve for i by trial and error or spreadsheet:
i = 38.9% (Excel)

2.56 500,000 = 75,000(P/A,10%,n)
(P/A,10%,n) = 6.6667

From 10% table, n is between 11 and 12 years; therefore, n = 11 years

2.57 160,000 = 30,000(P/A,12%,n)
(P/A,12%,n) = 5.3333

From 12% table, n is between 9 and 10 years; therefore, n = 10 years

2.58 2,000,000 = 100,000(P/A,4%,n)
(P/A,4%,n) = 20.000

From 4% table, n is between 40 and 45 years; by spreadsheet, $42 > n > 41$
Therefore, n = 41 years

2.59 1,500,000 = 3,000,000(P/F,20%,n)
(P/F,20%,n) = 0.5000

From 20% table, n is between 3 and 4 years; therefore, n = 4 years

2.60 100,000 = 1,600,000(P/F,18%,n)
(P/F,18%,n) = 0.0625

From 18% table, n is between 16 and 17 years; therefore, n = 17 years

2.61 10A = A(F/A,10%,n)
(F/A,10%,n) = 10.000

From 10% table, n is between 7 and 8 years; therefore, n = 8 years

2.62 $1{,}000{,}000 = 10{,}000\{1 - [(1+0.10)^n/(1+0.07)^n\}]\}/(0.07 - 0.10)$
By trial and error, n = is between 50 and 51; therefore, n = 51 years

2.63 $12{,}000 = 3000 + 2000(A/G,10\%,n)$
$(A/G,10\%,n) = 4.5000$

From 10% table, n is between 12 and 13 years; therefore, n = 13 years

FE Review Solutions

2.64 $P = 61{,}000(P/F,6\%,4)$
$= 61{,}000(0.7921)$
$= \$48{,}318$
Answer is (c)

2.65 $160 = 235(P/F,i,5)$
$(P/F,i,5) = 0.6809$
From tables, i = 8%
Answer is (c)

2.66 $23{,}632 = 3000\{1- [(1+0.04)^n/(1+0.06)^n]\}/(0.06-0.04)$
$[(23{,}632*0.02)/3000]-1 = (0.98113)^n$
log 0.84245 = nlog 0.98113
n = 9
Answer is (b)

2.67 $109.355 = 7(P/A,i,25)$
$(P/A,i,25) = 15.6221$
From tables, i = 4%
Answer is (a)

2.68 $A = 2{,}800{,}000(A/F,6\%,10)$
$= \$212{,}436$
Answer is (d)

2.69 $A = 10{,}000{,}000((A/P,15\%,7)$
$= \$2{,}403{,}600$
Answer is (a)

2.70 $P = 8000(P/A,10\%,10) + 500(P/G,10\%,10)$
$= 8000(6.1446) + 500(22.8913)$
$= \$60{,}602.45$
Answer is (a)

2.71 F = 50,000(F/P,18%,7)
= 50,000(3.1855)
= $159,275
Answer is (b)

2.72 P = 10,000(P/F,10%,20)
= 10,000(0.1486)
= $1486
Answer is (d)

2.73 F = 100,000(F/A,18%,5)
= 100,000(7.1542)
= $715,420
Answer is (c)

2.74 P = 100,000(P/A,10%,5) - 5000(P/G,10%,5)
= 100,000(3.7908) - 5000(6.8618)
= $344,771
Answer is (a)

2.75 F = 20,000(F/P,12%,10)
= 20,000(3.1058)
= $62,116
Answer is (a)

2.76 A = 100,000(A/P,12%,5)
= 100,000(0.27741)
= $27,741
Answer is (b)

2.77 A = 100,000(A/F,12%,3)
= 100,000(0.29635)
= $29,635
Answer is (c)

2.78 A = 10,000(F/A,12%,25)
= 10,000(133.3339)
= $1,333,339
Answer is (d)

2.79 F = 10,000(F/P,12%,5) + 10,000(F/P,12%,3) + 10,000
= 10,000(1.7623) + 10,000(1.4049) + 10,000
= $41,672
Answer is (c)

2.80 P = 8,000(P/A,10%,5) + 900(P/G,10%,5)
= 8,000(3.7908) + 900(6.8618)
= $36,502
Answer is (d)

2.81 100,000 = 20,000(P/A,i,10)
(P/A,i,10) = 5.000
i is between 15 and 16%
Answer is (a)

2.82 60,000 = 15,000(P/A,18%,n)
(P/A,18%,n) = 4.000
n is between 7 and 8
Answer is (b)

Case Study Solution

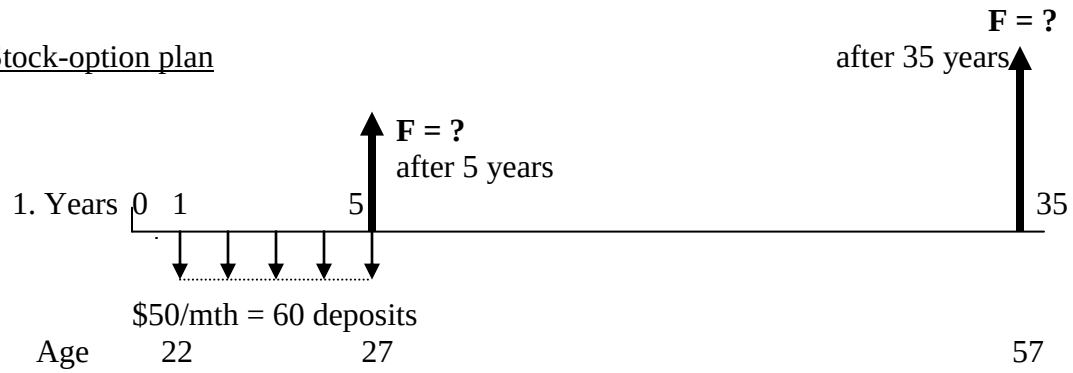
I. Manhattan Island

Simple interest
n = 375 years from 1626 – 2001

P + I = P + nPi = 375(24)(.06) + 24
= P(1 + ni) = 24(1 + 375(.06))
= $564

Compound interest
F = P(F/P,6%,375)
= 24(3,088,157,729.0)
= $74,115,785,490, which is $74+ billion

II. Stock-option plan



2. Value when leaving the company

F = A(F/A,1.25%,60)
= 50(88.5745)
= $4428.73

3. Value at age 57 (n = 30 years)

F = P(F/P,15%,30)
= 4428.73(66.2118)
= $293,234

4. Amount for 7 years to accumulate F = $293,234

A = F(A/F,15%,7)
= 293,234(.09036)
= $26,497 per year

5. Amount in 20's: 5(12)50 = $3000
Amount in 50's: 7(26,497) = $185,479