Chapter 9 Solution

Exercise 23

1. (a) $P = 360000\left(1+\frac{3}{(100)(2)}\right)^{(2)(8)}$ (M1)(A1) for substitution

$P = 456834.7972$

$P = 456800 \text{ EUR}$ A1 N3

By TVM Solver :
N = 8
I% = 3
PV = –360000
PMT = 0
FV = ?
P / Y = 1
C / Y = 2
PMT : END

(M1)(A1) for correct values

$P = 456800 \text{ EUR}$ A1 N3

[3]

(b) $Q\left(1+\frac{3}{(100)(12)}\right)^{(12)(8)} = 456834.7972$ (M1)(A1) for correct equation

$Q(1.0025)^{96} = 456834.7972$

$Q = 359466.6239$

$Q = 359500 \text{ EUR}$ A1 N3

By TVM Solver :
N = 8
I% = 3
PV = ?
PMT = 0
FV = 456834.7972
P / Y = 1
C / Y = 12
PMT : END

(M1)(A1) for correct values

$Q = 359500 \text{ EUR}$ A1 N3

[3]

2. (a) The amount of money

$= 125000\left(1+\frac{8}{100}\right)^{12}$ (M1)(A1) for substitution

$= 314771.2646$

$= \$315000$ A1 N3

By TVM Solver :
N = 12
I% = 8
PV = –125000
PMT = 0
FV = ?
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

The amount of money is \$315000. A1 N3

[3]

(b) $125000\left(1+\frac{8}{100}\right)^{t} = 250000$ (M1)(A1) for correct equation

$1.08^t = 2$

$1.08^t - 2 = 0$

By considering the graph of $y = 1.08^t - 2$,

$t = 9.0064683$.

Thus, the minimum number of years is 10. A1 N3

By TVM Solver :
N = ?
I% = 8
PV = –125000
PMT = 0
FV = 250000
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

Thus, the minimum number of years is 10. A1 N3

[3]

3. (a) $P\left(1+\frac{4}{(100)(4)}\right)^{(4)(5)} = 87000$ (M1)(A1) for correct equation

$P(1.01)^{20} = 87000$

$P = 71300.36892$

$P = 71300$ A1 N3

By TVM Solver :
N = 5
I% = 4
PV = ?
PMT = 0
FV = 87000
P / Y = 1
C / Y = 4
PMT : END

(M1)(A1) for correct values

$P = 71300$ A1 N3

[3]

(b) $P\left(1+\frac{4}{(100)(4)}\right)^{4t} = 2.5P$ (M1)(A1) for correct equation

$1.01^{4t} = 2.5$

$1.01^{4t} - 2.5 = 0$

By considering the graph of $y = 1.01^{4t} - 2.5$,

$t = 23.021615$.

Thus, the minimum number of years is 24. A1 N3

By TVM Solver :
N = ?
I% = 4
PV = −71300
PMT = 0
FV = 178250
P / Y = 1
C / Y = 4
PMT : END

(M1)(A1) for correct values

Thus, the minimum number of years is 24. A1 N3

[3]

4. $640000\left(1+\frac{5}{(100)(2)}\right)^{2t_1}=1280000$ (M1)(A1) for correct equation

$1.025^{2t_1}=2$

$1.025^{2t_1}-2=0$

By considering the graph of $y=1.025^{2t_1}-2$,

$t_1=14.035517$.

By TVM Solver :
N = ?
I% = 5
PV = –640000
PMT = 0
FV = 1280000
P / Y = 1
C / Y = 2
PMT : END

(M1)(A1) for correct values

Thus, $t_1=14.035517$.

$640000\left(1+\frac{5}{(100)(4)}\right)^{4t_2}=1280000$ (M1)(A1) for correct equation

$1.0125^{4t_2}=2$

$1.0125^{4t_2}-2=0$

By considering the graph of $y=1.0125^{4t_2}-2$,

$t_2=13.949408$.

By TVM Solver :
N = ?
I% = 5
PV = –640000
PMT = 0
FV = 1280000
P / Y = 1
C / Y = 4
PMT : END

(M1)(A1) for correct values

Thus, $t_2=13.949408$.

$t_1-t_2=14.035517-13.949408$ (M1) for valid approach

$t_1-t_2=0.086109$

$t_1-t_2=0.0861$ A1 N6

[6]

Exercise 24

1. (a) $P = 54000\left(1+\frac{6}{(100)(12)}\right)^{(12)(10)}$ (M1)(A1) for substitution

$P = 98247.42364$

$P = 98000$ EUR A1 N3

By TVM Solver :
N = 10
I% = 6
PV = –54000
PMT = 0
FV = ?
P / Y = 1
C / Y = 12
PMT : END

(M1)(A1) for correct values

$P = 98000$ EUR A1 N3

[3]

(b) $54000\left(1+\frac{r}{(100)(4)}\right)^{(4)(10)} = 98247.42364$ (M1)(A1) for correct equation

$54000\left(1+\frac{r}{400}\right)^{40} - 98247.42364 = 0$

By considering the graph of

$y = 54000\left(1+\frac{r}{400}\right)^{40} - 98247.42364$, $r = 6.03005$.

Thus, $r = 6.03$. A1 N3

By TVM Solver :
N = 10
I% = ?
PV = –54000
PMT = 0
FV = 98247.42364
P / Y = 1
C / Y = 4
PMT : END

(M1)(A1) for correct values

Thus, $r = 6.03$. A1 N3

[3]

2. (a) $P\left(1+\frac{9}{(100)(2)}\right)^{(7)(2)}=1600000$ (M1)(A1) for substitution

$P=863956.5796$

$P=860000$ A1 N3

By TVM Solver :
N = 7
I% = 9
PV = ?
PMT = 0
FV = 1600000
P / Y = 1
C / Y = 2
PMT : END

(M1)(A1) for correct values

$P=860000$ A1 N3

[3]

(b) $863956.5796\left(1+\frac{9}{100}\right)^{n}=1600000$ (M1)(A1) for correct equation

$863956.5796(1.09)^{n}-1600000=0$

By considering the graph of

$y=863956.5796(1.09)^{n}-1600000$,

$n=7.1507643$.

Thus, $n=7.15$. A1 N3

By TVM Solver :
N = ?
I% = 9
PV = –863956.5796
PMT = 0
FV = 1600000
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

Thus, $n=7.15$. A1 N3

[3]

3. $\left(1+\frac{12}{(100)(4)}\right)^{(4)(4)}=\left(1+\frac{12}{(100)(12)}\right)^{(12)(n)}$ (M1)(A1) for correct equation

$1.03^{16}=1.01^{12n}$ (M1) for simplification

$1.03^{16}-1.01^{12n}=0$

By considering the graph of $y=1.03^{16}-1.01^{12n}$,

$n=3.9608468$.

Thus, $n=3.96$. A1 N4

[4]

4. $\left(1+\frac{5}{(100)(2)}\right)^{(2)(8)}=\left(1+\frac{5}{100k}\right)^{(k)(7.98)}$ (M1)(A1) for correct equation

$1.025^{16}=\left(1+\frac{1}{20k}\right)^{7.98k}$ (M1) for simplification

$1.025^{16}-\left(1+\frac{1}{20k}\right)^{7.98k}=0$

By considering the graph of $y=1.025^{16}-\left(1+\frac{1}{20k}\right)^{7.98k}$,

$k=2.5125342$.

Thus, $k=2.51$. A1 N4

[4]

Exercise 25

1. (a) $P\left(1+\frac{7}{100}\right)^4 = 300000$ (M1)(A1) for substitution

$P = 228868.5636$

$P = 229000$ A1 N3

By TVM Solver :
N = 4
I% = 7
PV = ?
PMT = 0
FV = 300000
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

$P = 229000$ A1 N3

[3]

(b) 5.4% A1 N1

[1]

(c) The real value of amount of money

$= 228868.5636\left(1+\frac{5.4}{100}\right)^4$ (A1) for substitution

$= 282454.558$

$= \$282000$ A1 N2

By TVM Solver :
N = 4
I% = 5.4
PV = –228868.5636
PMT = 0
FV = ?
P / Y = 1
C / Y = 1
PMT : END

(A1) for correct values

Thus, the real value is \$282000. A1 N2

[2]

2. (a) Let $r\%$ be the nominal annual interest rate compounded yearly.

$$(1+r\%)^9 = \left(1+\frac{12}{(100)(12)}\right)^{(12)(9)}$$ (M1)(A1) for substitution

$1+r\% = 1.01^{12}$

$r = 12.68250301$

The real interest rate per year

$= 12.68250301\% - 1.8\%$ (M1) for valid approach

$= 10.88250301\%$

$= 10.9\%$ A1 N4

[4]

(b) The real value of amount of interest

$$= 8500\left(1+\frac{10.88250301}{100}\right)^9 - 8500$$ (M1)(A1) for substitution

$= 13037.04494$

$= 13000 \text{ EUR}$ A1 N3

By TVM Solver :
N = 9
I% = 10.88250301
PV = –8500
PMT = 0
FV = ?
P / Y = 1
C / Y = 1
PMT : END

(A1) for correct values

The real value of amount of interest

$= 21537.04494 - 8500$ (M1) for valid approach

$= 13037.04494$

$= 13000 \text{ EUR}$ A1 N3

[3]

3. (a) Let $r\%$ be the real interest rate per year.

$2800\left(1+\frac{r}{100}\right)^{12}=4000$ (M1)(A1) for substitution

$2800\left(1+\frac{r}{100}\right)^{12}-4000=0$

By considering the graph of

$y=2800\left(1+\frac{r}{100}\right)^{12}-4000$, $r=3.016904692$.

Thus, $r=3.02$. A1 N3

By TVM Solver :
N = 12
I% = ?
PV = –2800
PMT = 0
FV = 4000
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

Thus, $r=3.02$. A1 N3

[3]

(b) The rate of inflation per year

$=4\%-3.016904692\%$ (M1) for valid approach

$=0.9830953083\%$

$=0.983\%$ A1 N2

[2]

4. (a) Let $r\%$ be the nominal annual interest rate compounded yearly.

$$(1+r\%)^8 = \left(1+\frac{9.2}{(100)(4)}\right)^{(4)(8)}$$ (M1)(A1) for substitution

$1+r\% = 1.023^4$

$r = 9.522294784$

The real interest rate per year

$= 9.522294784\% - i\%$ (M1) for valid approach

$= (9.5223 - i)\%$ A1 N4

[4]

(b) $14500\left(1+\frac{9.5223-i}{100}\right)^8 = 18500$ (M1)(A1) for substitution

$14500\left(1+\frac{9.5223-i}{100}\right)^8 - 18500 = 0$

By considering the graph of

$y = 14500\left(1+\frac{9.5223-i}{100}\right)^8 - 18500$,

$i = 6.4301811$.

Thus, $i = 6.43$. A1 N3

By TVM Solver :
N = 8
I% = ?
PV = −14500
PMT = 0
FV = 18500
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

$i = 9.5223 - 3.092118852$

$i = 6.430181148$

$i = 6.43$ A1 N3

[3]

Exercise 26

1. (a) By TVM Solver:

N = 20
I% = 7.5
PV = 0
PMT = ?
FV = 60000
P / Y = 1
C / Y = 1
PMT : BEGIN

(M1)(A1) for correct values

PV = –1288.86651

Thus, the value of the regular payment per year is \$1290. A1 N3

[3]

(b) By TVM Solver:

N = ?
I% = 7.5
PV = 0
PMT = –1788.86651
FV = 60000
P / Y = 1
C / Y = 1
PMT : BEGIN

(M1)(A1) for correct values

N = 16.67555757

Thus, the number of years required is 16.7 years. A1 N3

[3]

2. (a) By TVM Solver:

$N = 5 \times 12$
$I\% = 3$
$PV = 0$
$PMT = -1000$
$FV = ?$
$P/Y = 12$
$C/Y = 1$
$PMT : END$

(M1)(A1) for correct values

$FV = 64580.96194$

Thus, the value of the investment after five years is \$64600. A1 N3

[3]

(b) By TVM Solver:

$N = 5 \times 12$
$I\% = 3$
$PV = 0$
$PMT = -1500$
$FV = ?$
$P/Y = 12$
$C/Y = 1$
$PMT : END$

(M1)(A1) for correct values

$FV = 96871.44291$

The value of the investment after ten years

$= 64580.96194 \times (1+3\%)^5 + 96871.44291$

$= 171738.4778$

$= \$172000$ A1 N3

[3]

3. (a) By TVM Solver:

$N = 15 \times 4$
$I\% = 5$
$PV = 0$
$PMT = -300$
$FV = ?$
$P/Y = 4$
$C/Y = 1$
$PMT : END$

(M1)(A1) for correct values

$FV = 26374.85909$

Thus, the value of the investment after fifteen years is \$26400. A1 N3

[3]

(b) By TVM Solver:

$N = 30 \times 4$
$I\% = 5$
$PV = 0$
$PMT = ?$
$FV = 3.5 \times 26374.85909$
$P/Y = 4$
$C/Y = 1$
$PMT : END$

(M1)(A1) for correct values

$PMT = -341.0277664$

Thus, the new amount of deposit is \$341. A1 N3

[3]

4. (a) By TVM Solver:

$N = 8 \times 12$
$I\% = 2.9$
$PV = 0$
$PMT = -100$
$FV = ?$
$P/Y = 12$
$C/Y = 1$
$PMT : BEGIN$

(M1)(A1) for correct values

$FV = 10799.30951$

Thus, the value of the investment after eight years for annuity X is \$10800. A1 N3

[3]

(b) By TVM Solver:

$N = 8 \times 12$
$I\% = 2.9$
$PV = 0$
$PMT = -200$
$FV = ?$
$P/Y = 12$
$C/Y = 1$
$PMT : BEGIN$

(M1)(A1) for correct values

$FV = 21598.61903$

The value of the investment after sixteen years for annuity X

$= 10799.30951 \times (1 + 2.9\%)^8 + 21598.61903$

$= 35172.96727$

$= \$35200$ A1 N3

[3]

(c) By TVM Solver:

$N = 16 \times 12$
$I\% = 2.9$
$PV = 0$
$PMT = ?$
$FV = 35172.96727$
$P/Y = 12$
$C/Y = 1$
$PMT : BEGIN$

(A1) for correct values

$PMT = -144.3072994$

Thus, $p = 144$. A1 N2

[2]

Exercise 27

1. (a) (i) By TVM Solver:

N = 144
I% = 3.7
PV = 1900000
PMT = ?
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

PMT = −16303.73311

Thus, the amount of monthly payment is \$16300. A1 N3

(ii) The total amount to be paid

= (16303.73311)(144) (M1) for valid approach

= 2347737.568

= \$2350000 A1 N2

(iii) The amount of interest paid

= 2347737.568 − 1900000 (M1) for valid approach

= 447737.5678

= \$448000 A1 N2

[7]

(b) (i) By TVM Solver:

N = ?
I% = 3.4
PV = 1900000 − 350000
PMT = −17500
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

N = 101.8779513

Thus, the number of months to repay the loan is 102 months. A1 N3

(ii) The total amount to be paid

= 350000 + (17500)(102) (M1) for valid approach

= \$2135000 A1 N2

(iii) The amount of interest paid

$= 2135000 - 1900000$ (M1) for valid approach

$= \$235000$ A1 N2

[7]

(c) The amount of monthly payment in option 1 is less than that in option 2. R1

Thus, the option 1 is better. A1 N2

[2]

(d) The amount of interest paid in option 2 is less than that in option 1. R1

Thus, the option 2 is better. A1 N2

[2]

2. (a) (i) By TVM Solver:

$N = 36$
$I\% = 4.5$
$PV = 40000 - 10000$
$PMT = ?$
$FV = 0$
$P/Y = 12$
$C/Y = 1$
$PMT : END$

(M1)(A1) for correct values

$PMT = -891.1985089$

Thus, the amount of monthly payment is \$891. A1 N3

(ii) The amount of interest paid

$= (891.1985089)(36) + 10000 - 40000$ (M1)(A1) for substitution

$= 2083.146321$

$= \$2080$ A1 N3

[6]

(b) (i) By TVM Solver:

$N = ?$
$I\% = 4.5$
$PV = 40000$
$PMT = -800$
$FV = 0$
$P/Y = 12$
$C/Y = 1$
$PMT : END$

(M1)(A1) for correct values

$N = 55.34864756$

Thus, the number of months to repay the loan is 56 months. A1 N3

(ii) The amount of interest paid

$= (800)(56) - 40000$ (M1)(A1) for substitution

$= \$4800$ A1 N3

[6]

(c) The amount of monthly payment in option 2 is less than that in option 1. R1

Thus, the option 2 is better. A1 N2

[2]

(d) The amount of interest paid in option 1 is less than that in option 2. R1

Thus, the option 1 is better. A1 N2

[2]

(e) By TVM Solver:

N = 60
I% = ?
PV = 40000
PMT = –900
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

I% = 13.24614765

Thus, $r = 13.2$. A1 N3

[3]

3. (a) (i) By TVM Solver:

N = 120
I% = 2
PV = 10000
PMT = ?
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

PMT = –91.93240592

Thus, the amount of monthly payment is \$91.9. A1 N3

(ii) The amount of interest paid

$= (91.93240592)(120) - 10000$ (M1)(A1) for substitution

$= 1031.88871$

$= \$1030$ A1 N3

[6]

(b) (i) By TVM Solver:

N = 60
I% = 2
PV = 10000
PMT = –91.93240592
FV = ?
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

FV = –5247.330813

Thus, the amount of the loan after 5 years is \$5247.330813.

By TVM Solver:

N = ?
I% = 2
PV = 5247.330813
PMT = –91.93240592 – 60
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

N = 35.59078942

Thus, the number of months to repay the loan is 96 months. A1 N5

(ii) The amount of interest paid

$= (91.93240592)(60)$
$+(91.93240592+60)(36)-10000$
$= 985.5109683$
$= \$986$

(M1)(A1) for substitution

A1 N3

(iii) The amount of interest paid in option 2 is less than that in option 1. R1 N1

[9]

(c) (i) By TVM Solver:

N = ?
I% = 2
PV = 10000
PMT = –91.93240592×1.5
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

N = 77.30461672

Thus, the number of months to repay the loan is 78 months. A1 N3

(ii) 18 months A1 N1

[4]

4. (a) (i) By TVM Solver:

N = 20
I% = 2
PV = 50000
PMT = ?
FV = 0
P / Y = 1
C / Y = 1
PMT : BEGIN

(M1)(A1) for correct values

PMT = –2997.878339

Thus, $R_1 = 3000$. A1 N3

(ii) By TVM Solver:

N = 20
I% = 2
PV = 50000
PMT = ?
FV = 0
P / Y = 1
C / Y = 1
PMT : END

(M1)(A1) for correct values

PMT = –3057.835906

Thus, $R_2 = 3060$. A1 N3

(iii) The difference between the total amounts to be paid for the version 1 and the version 2 A1 N1

(iv) Version 1 A1 N1

[8]

(b) (i) By TVM Solver:

N = 240
I% = 2
PV = 50000
PMT = ?
FV = 0
P / Y = 12
C / Y = 1
PMT : END

(M1)(A1) for correct values

PMT = –252.5132304

Thus, $R_3 = 253$. A1 N3

(ii) The amount of interest paid in version 3 A1 N1

(iii) The amount of interest paid in version 2

$= (3057.835906)(20) - 50000$ (M1) for valid approach

$= \$11156.71812$

The amount of interest paid in version 3

$= (252.5132304)(240) - 50000$ (M1) for valid approach

$= \$10603.1753$

Hence, the version 3 will have the smaller total amount to be paid. A1 N3

[7]