Engineering Economy
and the Decision-Making Process
Solutions Manual

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Engineering Economy and the Decision-Making Process by Joseph C. Hartman, ISBN 0-13-142401-7

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Chapter 1

Solutions

These are left to the reader.

Chapter 2

Solutions

2.1 Drill Problems

1. (a) Year 0: -\$100,000
   Year 1 - 5: \$48,000

   (b) Month 1-24: -\$5000

   (c) Year 0: -\$25,000
   Year 1: -\$1000
   Year 2: -\$1500
   Year 3: -\$2000
   Year 4: -\$2500
   Year 5: -\$1000

   (d) Quarter 1-4: -\$250,000
   Quarter $n : \$40,000(1 + 0.024)^{n-4}, \quad n = 5, 6, \ldots, 23$
   Quarter 24: $\$40,000(1 + 0.25)^{(20)} - \$10,000$

   (e) Year 1: -\$75,000
   Year 2: -\$75,000
   Year 3: -\$75,000
   Year 4: \$235,000

   (f) Year 0: -\$500,000
   Year $n : \$100,000 + \$10,000(n - 1) - \$15,000(1 + 0.032)^{n-1} \quad n = 1, 2, \ldots, 5$
   Year $m : \$140,000 - \$12,000(m - 5) - \$15,000(1 + 0.032)^{m-1} \quad m = 6, 7, \ldots, 10$

   (g) Year 0: -\$10,000
   Semi-Year 1 - 10: \$350
   Semi-Year 10: \$10,000

   (h) Year 0: \$95,000
   Year 1 - 6: \$18,000

   (i) Year 0: -\$15 million
   Years 1 - 7: \$60,000 per day continuous flow
   Year 7: -\$1 million

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(j) Year 0: -$2 million

Year 1 - 4: $125,000

Year 5: $175,000

2. The amount owed is:

For $N = 1$:

$$F = \$250,000 + \$250,000(.073)(1) = \$268,250$$

For $N = 2$:

$$F = \$250,000 + \$250,000(.073)(2) = \$286,500$$

For $N = 3.5$:

$$F = \$250,000 + \$250,000(.073)(3.5) = \$313,875$$

3. The interest rate is:

$$i = \frac{\$175,000 - \$150,000}{(\$150,000)(4)} = 0.0417 = 4.17\%$$

4. The interest table is given in the spreadsheet in Figure 2.1.

	A	B	C	D	E	F	G
1	Drill Problem 2.4				**Input**		
2					Principal	$85,000.00	
3	**Period**	**Interest**	**Amount Owed**		Interest	4.50%	per year
4	0	--	$85,000.00				
5	1	$3,825.00	$88,825.00		**Output**		
6	2	$3,997.13	$92,822.13		Table		
7	3	$4,177.00	$96,999.12				
8	4	$4,364.96	$101,364.08				
9	5	$4,561.38	$105,925.46				
10							

Figure 2.1: Interest due on five-year loan with 4.5% interest rate.

5. The total owed is:

$$F = \$40,000(1.038)^6 = \$50,031.57$$

Thus, the total interest paid is $50,031.57-$40,000.00=$10,031.57.

6. An interest rate of 6.25% compounded monthly is a nominal rate.

(a) Effective Monthly Rate:

$$i_m = \frac{r}{M} = \frac{0.0625}{12} = 0.0052 = 0.52\%$$

(b) Effective Quarterly Rate:

$$i_q = (1 + i_m)^3 - 1 = (1 + 0.0052)^3 - 1 = 0.0157 = 1.57\%$$

(c) Effective Semi-annual Rate:

$$i_{sa} = (1 + i_q)^2 - 1 = (1 + 0.0157)^2 - 1 = 0.0316 = 3.16\%$$

(d) Effective Annual Rate:

$$i_a = (1 + \frac{r}{M})^M - 1 = (1 + \frac{0.0625}{12})^{12} - 1 = 0.0643 = 6.43\%$$

7. An interest rate of 9.5% compounded quarterly is a nominal rate.

(a) Effective Monthly Rate:

$$i_{\mathrm{m}} = (1 + \frac{r}{M})^{lM} - 1 = (1 + \frac{0.095}{4})^{(\frac{1}{12})(4)} - 1 = 0.0079 = 0.79\%$$

(b) Effective Quarterly Rate:

$$i_{\mathrm{q}} = \frac{r}{M} = \frac{0.095}{4} = 0.0238 = 2.38\%$$

(c) Effective Semi-annual Rate:

$$i_{\mathrm{sa}} = (1 + \frac{r}{M})^{lM} - 1 = (1 + \frac{0.095}{4})^{(\frac{1}{2})(4)} - 1 = 0.0481 = 4.81\%$$

(d) Effective Annual Rate:

$$i_{\mathrm{a}} = (1 + \frac{r}{M})^M - 1 = (1 + \frac{0.095}{4})^4 - 1 = 0.0984 = 9.84\%$$

8. An interest rate of 8.0% compounded annually is both a nominal and an effective rate.

(a) Effective Monthly Rate:

$$i_m = (1 + \frac{r}{M})^{lM} - 1 = (1 + \frac{0.08}{1})^{(\frac{1}{12})(1)} - 1 = 0.00643 = 0.643\%$$

(b) Effective Quarterly Rate:

$$i_{\mathrm{q}} = (1 + \frac{r}{M})^{lM} - 1 = (1 + \frac{0.08}{1})^{(\frac{1}{4})(1)} - 11 = 0.0194 = 1.94\%$$

(c) Effective Semi-annual Rate:

$$i_{\mathrm{sa}} = (1 + \frac{r}{M})^{lM} - 1 = (1 + \frac{0.08}{1})^{(\frac{1}{2})(1)} - 1 = 0.0392 = 3.92\%$$

(d) Effective Annual Rate:

$$i_{\mathrm{a}} = \frac{r}{M} = \frac{0.08}{1} = 0.08 = 8\%$$

9. An interest rate of 7.45% compounded continuously is a nominal rate.

(a) Effective Daily Interest Rate:

$$i_d = e^{lr} - 1 = e^{(\frac{1}{365})0.0745} - 1 = 0.0002 = .02\%$$

(b) Effective Monthly Interest Rate:

$$i_m = e^{lr} - 1 = e^{(\frac{1}{12})0.0745} - 1 = 0.0062 = 0.62\%$$

(c) Effective Quarterly Interest Rate:

$$i_q = e^{lr} - 1 = e^{(\frac{1}{4})0.0745} - 1 = 0.0188 = 1.88\%$$

(d) Effective Semi-Annual Interest Rate:

$$i_{sa} = e^{lr} - 1 = e^{(\frac{1}{2})0.0745} - 1 = 0.0380 = 3.80\%$$

(e) Effective Annual Interest Rate:

$$i_a = e^r - 1 = e^{0.0745} - 1 = 0.0773 = 7.73\%$$

10.

$$r = i_q M = (0.032)4 = 0.128 = 12.8\% \text{ compounded quarterly.}$$

11.

$$r = i_m M = (0.0155)12 = 0.186 = 18.6\% \text{ compounded monthly.}$$

12.

$$r = i_a M = (0.102)1 = .102 = 10.2\% \text{ compounded annually.}$$

13. Define $i_1 = 1.25\%$ per month and $i_2 = 12.0\%$ compounded quarterly. Convert each to an effective quarterly rate for comparison:

$$i_1 = (1 + 0.0125)^3 - 1 = 0.0380 = 3.80\% \text{ per quarter.}$$

$$i_2 = \frac{0.12}{4} = 0.03 = 3.0\% \text{ per quarter.}$$

The 12% compounded quarterly loan is cheaper.

14. Define $i_1 = 14.3\%$ compounded semi-annually and $i_2 = 2.1\%$ per quarter. Convert each to an effective semi-annual rate for comparison:

$$i_1 = \frac{0.143}{2} = 0.0715 = 7.15\% \text{ per six months.}$$

$$i_2 = (1 + 0.021)^2 = 0.0424 = 4.24\% \text{ per six months.}$$

The 14.3% compounded semi-annually investment is better.

15. Define $i_1 = 7.35\%$ per year and $i_2 = 8.25\%$ compounded semi-annually. Convert each to an effective annual rate for comparison:

$$i_1 = 7.35\% \text{ per year.}$$

$$i_2 = (1 + \frac{0.0825}{2})^2 = 0.0842 = 8.42\% \text{ per year.}$$

The 7.35% per year loan is cheaper.

16. Define $i_1 = 4.35\%$ per quarter and $i_2 = 15.3\%$ compounded continuously. Convert each to an effective annual rate for comparison:

$$i_1 = (1 + 0.0435)^4 = 0.1857 = 18.57\% \text{ per year.}$$

$$i_2 = e^{0.153} - 1 = 0.1653 = 16.53\% \text{ per year.}$$

The 4.35% per quarter investment is better.

17. Average annual inflation rate over any N periods is

$$CPI_n(1+f)^N = CPI_{n+N}$$

(a) Between 1983-1987:

$$99.6(1+f)^4 = 113.6$$

$$f = 0.0334 = 3.34\%$$

(b) Between 1985-1992:

$$107.6(1+f)^7 = 140.3$$

$$f = 0.0386 = 3.86\%$$

(c) Between 1993-1999:

$$144.5(1+f)^6 = 166.6$$

$$f = 0.0240 = 2.40\%$$

(d) Between 2000-2001:

$$172.2(1+f)^1 = 177.1$$

$$f = 0.0285 = 2.85\%$$

(e) Between 2000-2002:

$$172.2(1+f)^2 = 179.9$$

$$f = 0.0221 = 2.21\%$$

18. Average annual inflation rate over any N periods is

$$CPI_n(1+f)^N = CPI_{n+N}$$

(a) Between 1993-1999:

Construction Machinery:

$$151.2(1+f)^6 = 170.8 \Rightarrow f = 0.0205 = 2.05\%.$$

Semiconductors:

$$141.9(1+f)^6 = 97.4 \Rightarrow f = -0.0608 = -6.08\%$$

(b) Between 1994-2002:

Construction Machinery

$$153.8(1+f)^8 = 175.9 \Rightarrow f = 0.0169 = 1.69\%$$

Semiconductors:

$$140.1(1+f)^8 = 83.8 \Rightarrow f = -0.0622 = -6.22\%$$

(c) Between 2000-2001:

Construction Machinery:

$$172.7(1+f)^1 = 173.5 \Rightarrow f = 0.0046 = 0.46\%$$

Semiconductors:

$$91.1(1+f)^1 = 86.8 \Rightarrow f = -0.0472 = -4.72\%$$

(d) Between 2000-2002:

Construction Machinery:

$$172.7(1+f)^2 = 175.9 \Rightarrow f = 0.0092 = 0.92\%$$

Semiconductors:

$$91.1(1+f)^2 = 83.8 \Rightarrow f = -0.0409 = -4.09\%$$

19. Current dollars:

$$\begin{aligned}
A_0 = -\$50,000(1+0.0375)^0 &= -\$50,000 \\
A_1 = \$20,000(1+0.0375)^1 &= \$20,750 \\
A_2 = \$20,000(1+0.0375)^2 &= \$21,528 \\
A_3 = \$20,000(1+0.0375)^3 &= \$22,335 \\
A_4 = \$20,000(1+0.0375)^4 &= \$23,173 \\
A_5 = \$20,000(1+0.0375)^5 &= \$24,042
\end{aligned}$$

20. Monthly inflation rate f_m should be converted to annual inflation rate f.

$$f = (1+f_m)^{12} - 1 = (1+0.0025)^{12} - 1 = 0.0304 = 3.04\%$$

Real dollars:

$$\begin{aligned}
A'_0 = \frac{-\$280,000}{(1+0.0304)^0} &= -\$280,000 \\
A'_1 = \frac{\$200,000}{(1+0.0304)^1} &= \$194,099 \\
A'_2 = \frac{\$300,000}{(1+0.0304)^2} &= \$282,559 \\
A'_3 = \frac{\$400,000}{(1+0.0304)^3} &= \$365,631 \\
A'_4 = \frac{\$500,000}{(1+0.0304)^4} &= \$443,554 \\
A'_5 = \frac{\$100,000}{(1+0.0304)^5} &= \$86,094
\end{aligned}$$

21. Quarterly inflation rate f_q should be converted to annual inflation rate f.

$$f = (1+f_q)^4 - 1 = (1+0.0105)^4 - 1 = 0.0427 = 4.27\%$$

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Current dollars:

$$\begin{aligned}
A_1 = \$120,000(1+0.0427)^1 &= \$125,124 \\
A_3 = \$180,000(1+0.0427)^3 &= \$204,057 \\
A_4 = \$210,000(1+0.0427)^4 &= \$248,231 \\
A_5 = \$250,000(1+0.0427)^5 &= \$308,132
\end{aligned}$$

22. Real dollars:

$$\begin{aligned}
A'_0 = \frac{-\$1,000,000}{(1+0.0279)^0} &= -\$1,000,000 \\
A'_1 = \frac{\$256,975}{(1+0.0279)^1} &= \$250,000 \\
A'_2 = \frac{\$316,974}{(1+0.0279)^2} &= \$300,000 \\
A'_3 = \frac{\$380,120}{(1+0.0279)^3} &= \$350,000 \\
A'_4 = \frac{\$446,543}{(1+0.0279)^4} &= \$400,000 \\
A'_5 = \frac{\$516,377}{(1+0.0279)^5} &= \$450,000
\end{aligned}$$

23. From the currency conversion table on December 31, 2004: C\$1.2034 and A\$1.2812 were worth USD\$1. First convert the assumed Canadian dollars to United States dollars:

$$\begin{aligned}
A_0 &= \frac{-\text{C}\$1,000,000}{1.2034} = -\$830,979 \\
A_1 &= \frac{\text{C}\$256,975}{1.2034} = \$213,541 \\
A_2 &= \frac{\text{C}\$316,974}{1.2034} = \$263,399 \\
A_3 &= \frac{\text{C}\$380,120}{1.2034} = \$315,872 \\
A_4 &= \frac{\text{C}\$446,543}{1.2034} = \$371,068 \\
A_5 &= \frac{\text{C}\$516,377}{1.2034} = \$429,098
\end{aligned}$$

Now convert the United States dollars to Australian dollars.

$$\begin{aligned}
A_0 &= -\$830,979(1.2812) = -\text{A}\$1,064,650 \\
A_1 &= \$213,541(1.2812) = \text{A}\$273,588 \\
A_2 &= \$263,399(1.2812) = \text{A}\$337,466 \\
A_3 &= \$315,872(1.2812) = \text{A}\$404,695 \\
A_4 &= \$371,068(1.2812) = \text{A}\$475,412 \\
A_5 &= \$429,098(1.2812) = \text{A}\$549,760
\end{aligned}$$

24. From the currency conversion table on December 30, 2005: YEN117.88 and EUR0.8445 are worth USD\$1. First convert the assumed Japanese yen to United States dollars:

$$A_0 = \frac{-\text{YEN}1,000,000}{117.88} = -\$8483.20$$

$$\begin{aligned}
A_1 &= \frac{\text{YEN}256,975}{117.88} = \$2179.97\\
A_2 &= \frac{\text{YEN}316,974}{117.88} = \$2688.95\\
A_3 &= \frac{\text{YEN}380,120}{117.88} = \$3224.64\\
A_4 &= \frac{\text{YEN}446,543}{117.88} = \$3788.12\\
A_5 &= \frac{\text{YEN}516,317}{117.88} = \$4380.02
\end{aligned}$$

Now convert the US dollars to Euros:

$$\begin{aligned}
A_0 &= -\$8483.20(0.8445) = -\text{EUR}7164.06\\
A_1 &= \$2179.97(0.8445) = \text{EUR}1840.98\\
A_2 &= \$2688.95(0.8445) = \text{EUR}2270.82\\
A_3 &= \$3224.64(0.8445) = \text{EUR}2723.21\\
A_4 &= \$3788.12(0.8445) = \text{EUR}3199.07\\
A_5 &= \$4380.02(0.8445) = \text{EUR}3698.93
\end{aligned}$$

25. Annual inflation-free rate:

$$i' = \frac{(1+i)}{(1+f)} - 1 = \frac{1+0.125}{1+0.025} - 1 = 0.0976 = 9.76\%$$

26. Annual market interest rate:

$$i = (1+f)(1+i') - 1 = (1+0.035)(1+0.0745) - 1 = 0.1121 = 11.21\%$$

27. Annual inflation rate:

$$f = \frac{(1+i)}{(1+i')} - 1 = \frac{(1+0.0945)}{(1+0.0625)} - 1 = 0.0301 = 3.01\%$$

28. Annual inflation rate:

$$f = (1+f_m)^{12} - 1 = (1+0.00247)^{12} - 1 = 0.0300 = 3.00\%$$

Annual market interest rate:

$$i = (1+f)(1+i') - 1 = (1+0.03)(1+0.05) - 1 = 0.0815 = 8.15\%$$

29. Monthly inflation rate:

$$f_m = \frac{(1+i)}{(1+i')} - 1 = \frac{(1+0.015)}{(1+0.0125)} - 1 = 0.00247 = 0.247\%$$

Quarterly inflation rate:

$$f_q = (1+f_m)^3 - 1 = (1+0.00247)^3 - 1 = 0.00743 = 0.743\%$$

30. Annual inflation rate:

$$f = (1+f_{sa})^2 - 1 = (1+0.0138)^2 - 1 = 0.0278 = 2.78\%$$

Annual inflation-free rate:

$$i' = \frac{(1+i)}{(1+f)} - 1 = \frac{(1+0.11)}{(1+0.0278)} - 1 = 0.08 = 8.0\%$$

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2.2 Application Problems

1. (a) Cash inflows of \$30 million per year for five years.
   (b) 24 consecutive months of C\$666,667 payments.
   (c) Time 2003: -\$5.3 billion.
   Time 2004-2012: \$1.3 billion.
   Time 2013: \$1.8 billion.
   (d) Use continuous flows for years 2004 through 2013.
   (e) Time 0: -\$294 million
   Month 1-59: \$1.5876 million
   Month 60: \$119.19 million
   (f) Time 0: -\$294 million
   Month 1-12: \$1.058 million
   Month 13-24: \$1.323 million
   Month 25-36: \$1.588 million
   Month 37-48: \$1.852 million
   Month 49-60: \$2.117 million
   Month 60: \$117.60 million
   (g) Five years of C\$2.4 million per year, or \$2.06 million per year.
   (h) The cash flow diagram is given in the spreadsheet in Figure 2.2 assuming net revenues of \$20,000 per bus.

	A	B	C	D	E	F
1	Application Problem 2.1h			**Input**		
2				Initial Sales	6.00	buses
3	**Period**	**Cash Flow**		G (Sales)	5.00	buses
4	0			Price	\$20,000.00	per bus
5	1	\$120,000.00				
6	2	\$220,000.00		**Output**		
7	3	\$320,000.00		Table		
8	4	\$420,000.00				
9	5	\$520,000.00				
10	6	\$620,000.00				
11	7	\$720,000.00				
12	8	\$820,000.00				
13	9	\$920,000.00				
14	10	\$1,020,000.00				
15	11	\$1,120,000.00				
16	12	\$1,220,000.00				

Figure 2.2: Cash flow diagram for bus sales.

2. The cash flow diagram is given in the spreadsheet in Figure 2.3.

3. Amount owed at the end of one year:

$$\begin{aligned} F &= P(1+i) \\ \$228,960 &= 12(\$18,000)(1+i) \\ \Rightarrow i &= 0.06 = 6.0\% \end{aligned}$$

The effective monthly rate is:

$$i_m = (1+i)^{1/12} - 1 = (1+0.06)^{1/12} - 1 = 0.00487 = 0.49\%$$

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	A	B	C	D	E	F
18	Application Problem 2.2			**Input**		
19				Investment	$153,000,000.00	
20	**Period**	**Cash Flow**		Init Production	5,000.00	per day
21	0	-$76,500,000.00		Production (G)	5,000.00	per day
22	1	-$76,500,000.00		Max Prod	20,000.00	per day
23	2	-$72,510,000.00		Prod Days	200.00	per year
24	3	$54,980,000.00		Yield	0.448	ounce per ton
25	4	$182,470,000.00		Cost	$6.91	per ton
26	5	$309,960,000.00		Price	$300.00	per ounce
27	6	$309,960,000.00		Fixed Cost	$200,000,000.00	million per year
28	7	$309,960,000.00		Salvage Value	-$15,000,000.00	million
29	8	$309,960,000.00				
30	9	$309,960,000.00				
31	10	$309,960,000.00		**Output**		
32	11	$309,960,000.00		Table		
33	12	$309,960,000.00				
34	13	$309,960,000.00				
35	14	$309,960,000.00				
36	15	$309,960,000.00				
37	16	$309,960,000.00				
38	17	$309,960,000.00				
39	18	$309,960,000.00				
40	19	$309,960,000.00				
41	20	$309,960,000.00				
42	21	$294,960,000.00				

Figure 2.3: Cash flow diagram for mine investment.

If they wait five years to pay:

$$F = \$216,000(1 + 0.06)^5 = \$289,056.$$

4. Effective annual rate for interest rate of 5% compounded daily:

$$i = (1 + \frac{0.05}{365})^{365} - 1 = 0.0513 = 5.13\% \text{ per year.}$$

If they make payments after 4 years:

$$F = P(1 + i)^4 = \$340,000(1.0513)^4 = \$415,323.$$

The total interest paid is \$415,323 - \$340,000 = \$75,323.

Effective annual rate for interest rate of 5.4% compounded semi-annually:

$$i = (1 + \frac{.054}{2})^2 - 1 = 0.0547 = 5.47\% \text{ per year.}$$

The rate of 5% compounded daily, which is offered by the first local bank, is a cheaper rate than the 5.4% compounded semi-annually which is offered by the other local bank.

5. Interest paid if paid after year one is:

$$\text{EUR}54.2\text{M}(1.0575) - \text{EUR}54.2\text{M} = \text{EUR}3,116,500.$$

Interest paid if paid after two years:

$$\text{EUR}54.2\text{M}(1.0575)^2 - \text{EUR}54.2\text{M} = \text{EUR}6,412,198.75.$$

Thus, EUR3,295,698.75 is saved in interest.

6. Define $i_1 = 8.5\%$ compounded daily and $i_2 = 0.75\%$ per month. Convert each to an effective annual rate for comparison:

$$i_1 = e^{0.085} - 1 = 0.0887 = 8.87\% \text{ per year.}$$

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$$i_2 = (1 + 0.0075)^{12} - 1 = 0.0938 = 9.38\% \text{ per year.}$$

As a result, the 8.5% loan is cheaper. The EUR250,000 cost is \$296,033 in U.S. dollars on December 30, 2005.

7. Define $i_1 = 6.5\%$ compounded continuously and $i_2 = 6.6\%$ compounded quarterly. Convert each to an effective annual rate for comparison:

$$i_1 = e^{0.065} - 1 = 0.0672 = 6.72\% \text{ per year.}$$

$$i_2 = (1 + \frac{0.066}{4})^4 - 1 = 0.0677 = 6.77\% \text{ per year.}$$

The 6.5% loan is cheaper.

8. The cash flow stream in current dollars is defined by the actual dollars received:

$$\begin{aligned} A_0 &= -\$10,000 \\ A_{0.5} &= \$306.25 \\ A_1 &= \$306.25 \\ &\vdots \\ A_{8.5} &= \$306.25 \\ A_9 &= \$10,000 + \$306.25 \end{aligned}$$

Assuming a 2.3% semi-annual rate of inflation, the real dollars are:

$$\begin{aligned} A'_0 &= -\$10,000 \\ A'_{0.5} &= \frac{\$306.25}{1.023} = \$313.29 \\ A'_1 &= \frac{\$306.25}{1.023^2} = \$292.63 \\ &\vdots \\ A'_{8.5} &= \frac{\$306.25}{1.023^{17}} = \$208.06 \\ A'_9 &= \frac{\$10,000 + \$306.25}{1.023^{18}} = \$6844.46 \end{aligned}$$

9. Current dollars:

$$\begin{aligned} A_0 &= -\$5.3 \text{ billion.} \\ A_1 &= -200,000(250)(\$14)(1+0.005)^1 + 200,000(250)(\$40)(1+0.012)^1 = \$1.32 \text{ billion.} \\ &\vdots \\ A_9 &= -200,000(250)(\$14)(1+0.005)^9 + 200,000(250)(\$40)(1+0.012)^9 = \$1.49 \text{ billion.} \\ A_{10} &= -200,000(250)(\$14)(1+0.005)^{10} + 200,000(250)(\$40)(1+0.012)^{10} + \$500\text{M}(1+0.013)^{10} \\ &= \$1.52 \text{ billion.} \end{aligned}$$

10. Current dollars:

$$A_0 = -\$294 \text{ million.}$$

$$
\begin{aligned}
A_1 &= \$132,300(1+0.003)^1 = \$132,697 \\
A_2 &= \$132,300(1+0.003)^2 = \$133,095 \\
A_3 &= \$132,300(1+0.003)^3 = \$133,494 \\
&. \\
&. \\
&. \\
&. \\
A_{60} &= \$132,300(1+0.003)^{60} + (.4)(\$294\text{M})(1+0.025)^5 = \$133,211,955
\end{aligned}
$$

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