1. **Compound interest.** (p.38)[1] An amount, F, 6 years in the future, is equivalent to \$1,500 now, when the annual interest rate is 12%. What is the value of F?

2. **Compound interest.** (p.38)[2] How much interest is payable each year on a loan of \$2,000 if the interest rate is 10% per year when half of the loan principal will be repaid as a lump sum at the end of 4 years and the other half will be repaid as a lump sum at the end of 8 years? How much interest will be paid over the 8-year period?

3. **Compound interest.** (p.38)[3] In problem 2, if the interest had not been paid each year and if the principal was repaid entirely at the end, how much interest would be due at the end of the 8th year?

4. **Equivalent annual payment.** (p.38)[4] A present obligation of \$20,000 is to be repaid in equal uniform annual amounts, each of which includes repayment of the debt (principal) and interest on the debt, over a period of 5 years. If the interest rate is 10% per year, what is the amount of the annual payment?

5. **Compound interest.** (p.39)[5] Suppose that the \$20,000 in problem 4 is to be repaid at the rate of \$4,000 per year plus the interest that is owed based on the beginning-of-year unpaid principal. Compute the total amount of interest paid in this situation and compare it with problem 4.

[1] DeGarmo, 3-10, p.123.
[2] DeGarmo, 3-4, p.122.
[3] DeGarmo, $\sim$3-5, p.122.
[4] DeGarmo, 3-11, p.123.
[5] DeGarmo, 3-12, p.123.

Solution to Problem 1, Compound interest, (p.2). The basic relation is:

$$F = (1+i)^N P \tag{36}$$

In our case, $i = 0.12$, $N = 6$ and $P = 1,500$. Thus $F = \$2,960.73$.

Solution to Problem 2, Compound interest, (p.2). See table 4, which explains that:

$200 interest is paid each year for years 1–4.

$100 interest is paid each year for years 5–8.

$1,200 is the total interest paid.

Year	Amount owed at beginning of year	Interest accrued for year	Payment at end of year
1	2,000	200	200
2	2,000	200	200
3	2,000	200	200
4	2,000	200	1,200
5	1,000	100	100
6	1,000	100	100
7	1,000	100	100
8	1,000	100	1,100
Total:		1,200	3,200

Table 4: Solution to problem 2.

Solution to Problem 3, Compound interest, (p.2). See table 5.

- 2nd column (amount owed at beginning of each year):
  Compound interest on principal: row n = $1.1^{n-1}\times$ row 1.
- 3rd column (interest accrued for year):
  3rd column = 0.1 $\times$ 2nd column.
- Thus the total interest paid is $2,287.17, which is much greater than in problem 2 because of (1) compounding (2) deferred repayment of all principal to year 8.

Year	Amount owed at beginning of year	Interest accrued for year	Payment at end of year
1	2,000	200	0
2	2,200	220	0
3	2,420	242	0
4	2,662	266.20	0
5	2,928.20	292.82	0
6	3,221.02	322.10	0
7	3,543.12	354.31	0
8	3,897.43	389.74	4,287.17
Total:		2,287.17	4,287.17

Table 5: Solution to problem 3.

Solution to Problem 4, Equivalent annual payment, (p.2). The basic relation is:

$$A = \frac{i(1+i)^N}{(1+i)^N - 1} P \tag{37}$$

In our case: $i = 0.1$, $N = 5$, $P = 20,000$. Thus:

$$A = 0.263797 \times 20,000 = \$5,275.95 \tag{38}$$

Solution to Problem 5, Compound interest, (p.2). See table 6.

- 2nd column (amount owed at beginning of each year):
  Remaining principal minus last year's payment of $4,000.
- 3rd column (interest accrued for year):
  3rd column = 0.1 $\times$ 2nd column.
- Thus the total interest paid is $6,000.
- The total payment in problem 4 is $5 \times 5,275.95 = \$26,379.75$. Thus the interest paid in problem 4 is $6,379.75.
- The interest paid in problem 4 is greater than in problem 5 because of repayment of principal during the loan in problem 5.

Year	Amount owed at beginning of year	Interest accrued for year	Payment at end of year
1	20,000	2,000	6,000
2	16,000	1,600	5,600
3	12,000	1,200	5,200
4	8,000	800	4,800
5	4,000	400	4,400
Total:		6,000	26,000

Table 6: Solution to problem 5.