Chapter 3
Understanding Money Management

- Nominal and Effective Interest Rates
- Equivalence Calculations
- Changing Interest Rates
- Debt Management
Understanding Money Management

- Financial institutions often quote interest rate based on an APR.
- In all financial analysis, we need to convert the APR into an appropriate effective interest rate based on a payment period.
- When payment period and interest period differ, calculate an effective interest rate that covers the payment period.
Understanding Money Management

Pay the minimum, pay for years
Making minimum payments on your credit cards can cost you a bundle over a lot of years. Here’s what would happen if you paid the minimum—or more—every month on a $2,705 card balance, with a 18.38% interest rate.

Payment rate
2% of balance
4% of balance
8% of balance

How long to pay off debt
27 years, 2 months
8 years, 5 months
2 years, 1 month

Interest paid
$11,047
$2,707
$594

(Source: USA Today, April 21, 1998, © USA Today, used with permission)
Focus

1. If payments occur more frequently than annual, how do we calculate economic equivalence?
2. If interest period is other than annual, how do we calculate economic equivalence?
3. How are commercial loans structured?
4. How should you manage your debt?
Nominal Versus Effective Interest Rates

Nominal Interest Rate:
Interest rate quoted based on an annual period

Effective Interest Rate:
Actual interest earned or paid in a year or some other time period
18% Compounded Monthly

- Nominal interest rate
- Interest period
- Annual percentage rate (APR)
18% Compounded Monthly

What It Really Means?

- Interest rate per month \((i) = \frac{18\%}{12} = 1.5\%\)
- Number of interest periods per year \((N) = 12\)

In words,

- Bank will charge 1.5% interest each month on your unpaid balance, if you borrowed money
- You will earn 1.5% interest each month on your remaining balance, if you deposited money
Question: Suppose that you invest $1 for 1 year at 18% compounded monthly. How much interest would you earn?

Solution: 

\[ F = 1(1 + i)^{12} = 1(1 + 0.015)^{12} \]

\[ = 1.1956 \]

\[ i_a = 0.1956 \text{ or } 19.56\% \]
18% compounded monthly

or

1.5% per month for 12 months

= 19.56% compounded annually
Effective Annual Interest Rate (Annual Effective Yield)

\[ i_a = \left(1 + \frac{r}{M}\right)^M - 1 \]

- \( r \) = nominal interest rate per year
- \( i_a \) = effective annual interest rate
- \( M \) = number of interest periods per year
Practice Problem

- If your credit card calculates the interest based on 12.5% APR, what is your monthly interest rate and annual effective interest rate, respectively?

- Your current outstanding balance is $2,000 and skips payments for 2 months. What would be the total balance 2 months from now?
Solution

Monthly Interest Rate:

\[ i = \frac{12.5\%}{12} = 1.0417\% \]

Annual Effective Interest Rate:

\[ i_a = (1 + 0.010417)^{12} - 1 = 13.24\% \]

Total Outstanding Balance:

\[ F = B_2 = \$2,000(F / P, 1.0417\%, 2) \]
\[ = \$2,041.88 \]
Practice Problem

Suppose your savings account pays 9% interest compounded quarterly. If you deposit $10,000 for one year, how much would you have?
Solution

(a) Interest rate per quarter:

\[ i = \frac{9\%}{4} = 2.25\% \]

(b) Annual effective interest rate:

\[ i_a = (1 + 0.0225)^4 - 1 = 9.31\% \]

(c) Balance at the end of one year (after 4 quarters)

\[
F = $10,000(F / P, 2.25\%, 4) \\
= $10,000(F / P, 9.31\%, 1) \\
= $10,931
\]
Effective Annual Interest Rates
(9% compounded quarterly)

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Base amount + Interest (2.25%)</th>
<th>Value after one year</th>
</tr>
</thead>
<tbody>
<tr>
<td>First quarter</td>
<td>$10,000 + $225</td>
<td>$10,930.83</td>
</tr>
<tr>
<td>Second quarter</td>
<td>= New base amount + Interest (2.25%)</td>
<td>= $10,455.06 + $235.24</td>
</tr>
<tr>
<td>Third quarter</td>
<td>= New base amount + Interest (2.25%)</td>
<td>= $10,690.30 + $240.53</td>
</tr>
<tr>
<td>Fourth quarter</td>
<td>= New base amount + Interest (2.25%)</td>
<td>= $10,930.83</td>
</tr>
</tbody>
</table>
## Nominal and Effective Interest Rates with Different Compounding Periods

<table>
<thead>
<tr>
<th>Nominal Rate</th>
<th>Compounding Annually</th>
<th>Compounding Semi-annually</th>
<th>Compounding Quarterly</th>
<th>Compounding Monthly</th>
<th>Compounding Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%</td>
<td>4.00%</td>
<td>4.04%</td>
<td>4.06%</td>
<td>4.07%</td>
<td>4.08%</td>
</tr>
<tr>
<td>5</td>
<td>5.00</td>
<td>5.06</td>
<td>5.09</td>
<td>5.12</td>
<td>5.13</td>
</tr>
<tr>
<td>6</td>
<td>6.00</td>
<td>6.09</td>
<td>6.14</td>
<td>6.17</td>
<td>6.18</td>
</tr>
<tr>
<td>7</td>
<td>7.00</td>
<td>7.12</td>
<td>7.19</td>
<td>7.23</td>
<td>7.25</td>
</tr>
<tr>
<td>8</td>
<td>8.00</td>
<td>8.16</td>
<td>8.24</td>
<td>8.30</td>
<td>8.33</td>
</tr>
<tr>
<td>9</td>
<td>9.00</td>
<td>9.20</td>
<td><strong>9.31</strong></td>
<td>9.38</td>
<td>9.42</td>
</tr>
<tr>
<td>10</td>
<td>10.00</td>
<td>10.25</td>
<td>10.38</td>
<td>10.47</td>
<td>10.52</td>
</tr>
<tr>
<td>11</td>
<td>11.00</td>
<td>11.30</td>
<td>11.46</td>
<td>11.57</td>
<td>11.62</td>
</tr>
<tr>
<td>12</td>
<td>12.00</td>
<td>12.36</td>
<td>12.55</td>
<td>12.68</td>
<td>12.74</td>
</tr>
</tbody>
</table>
Effective Interest Rate per Payment Period (i)

\[ i = \left[ 1 + \frac{r}{CK} \right]^C - 1 \]

\( C = \) number of interest periods per payment period

\( K = \) number of payment periods per year

\( M = \) number of interest periods per year

\( (M=CK) \)
12% compounded monthly

Payment Period = Quarter
Compounding Period = Month

- Effective interest rate per quarter
  \[ i = (1 + 0.01)^3 - 1 = 3.030\% \]

- Effective annual interest rate
  \[ i_a = (1 + 0.01)^{12} - 1 = 12.68\% \]
  \[ i_a = (1 + 0.03030)^4 - 1 = 12.68\% \]
Effective Interest Rate per Payment Period with Continuous Compounding

\[ i = \left[1 + \frac{r}{CK}\right]^C - 1 \]

where \( CK = \) number of compounding periods per year

continuous compounding \( \Rightarrow \) \( M (=CK) \rightarrow \infty \)

\[ i = \lim_{M \to \infty} \left[ 1 + \frac{r}{CK} \right]^C - 1 \]

\[ = \left( e^r \right)^{1/K} - 1 \]
Case 0: 8% compounded quarterly

Payment Period = Quarter
Interest Period = Quarterly

Given $r = 8\%$, $K = 4$ payments per year, $C = 1$ interest periods per quarter, $M = 4$ interest periods per year

\[
i = \left[1 + \frac{r}{CK}\right]^C - 1
\]

\[
= \left[1 + \frac{0.08}{(1)(4)}\right] - 1
\]

\[
= 2.000\%\ per\ quarter
\]
**Case 1: 8% compounded monthly**

Payment Period = Quarter
Interest Period = Monthly

Given $r = 8\%$, 

$K = 4$ payments per year 
$C = 3$ interest periods per quarter 
$M = 12$ interest periods per year 

\[ i = \left[ 1 + \frac{r}{CK} \right]^C - 1 \]

\[ = \left[ 1 + \frac{0.08}{3 \times 4} \right]^3 - 1 \]

\[ = 2.013\% \text{ per quarter} \]
Case 2: 8% compounded weekly

Payment Period = Quarter
Interest Period = Weekly

Given $r = 8\%$,

$K = 4$ payments per year
$C = 13$ interest periods per quarter
$M = 52$ interest periods per year

$i = \left[ 1 + \frac{r}{CK} \right]^C - 1$

$= \left[ 1 + \frac{0.08}{(13)(4)} \right]^{13} - 1$

$= 2.0186\%$ per quarter
Case 3: 8% compounded continuously

Payment Period = Quarter
Interest Period = Continuously

Given $r = 8\%$

$K = 4$ payments per year

$i = e^{r/K} - 1$

$= e^{0.02} - 1$

$= 2.0201\%$ per quarter
## Summary: Effective interest rate per quarter

<table>
<thead>
<tr>
<th>Case 0</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>8% compounded quarterly</td>
<td>8% compounded monthly</td>
<td>8% compounded weekly</td>
<td>8% compounded continuously</td>
</tr>
<tr>
<td>Payments occur quarterly</td>
<td>Payments occur quarterly</td>
<td>Payments occur quarterly</td>
<td>Payments occur quarterly</td>
</tr>
<tr>
<td>2.000% per quarter</td>
<td>2.013% per quarter</td>
<td>2.0186% per quarter</td>
<td>2.0201% per quarter</td>
</tr>
</tbody>
</table>
Practice Example

- 1000 YTL initial deposit.
  - Effective interest rate per quarter
  - Balance at the end of 3 years for a nominal rate of 8% compounded \textit{weekly}?

\[
i = \left(1 + \frac{0.08}{52}\right)^{13} - 1 = 2.0186\% \quad \text{per quarter}
\]

\[
F = 1000(1 + 0.020186)^{12} = 1271.03
\]

or

\[
F = 1000(F \mid P, 2.0186\%, 12)
\]
Practice Example

1000 YTL initial deposit.

- Effective interest rate per quarter
- Balance at the end of 3 years for a nominal rate of 8% compounded daily?

\[
i = \left(1 + \frac{0.08}{365}\right)^{365/4} - 1 = 2.0199\% \text{ per quarter}
\]

\[
F = 1000(1 + 0.020199)^{12} = 1271.21
\]

or

\[
F = 1000(F \mid P, 2.0199\%, 12)
\]
Practice Example

1000 YTL initial deposit.

- Effective interest rate per quarter
- Balance at the end of 3 years for a nominal rate of 8% compounded continuously?

\[
i = e^{\frac{r}{k}} - 1 = e^{0.08/4} - 1 = 2.0201\% \quad \text{per quarter}
\]

\[
F = 1000(1 + 0.020201)^{12} = 1271.23
\]

or

\[
F = 1000(F \mid P, 2.0201\%, 12)
\]

Notice the negligible difference as compounding changes between weekly, daily, continuously!
Practice Example

2000 YTL borrowed. How much must be returned at the end of 3 years if $i$=6\% compounded monthly?

Interest rate per month = \( \frac{0.06}{12} = 0.005 \)

\[
F = 2000 \ (F \mid P, 0.5\%, 36)
\]

or

Effective interest rate per year = \( \left(1 + \frac{0.06}{12}\right)^{12} - 1 = 6.168\% \)

\[
F = 2000 \ (F \mid P, 6.168\%, 3)
\]

or

Effective interest rate per quarter = \( \left(1 + \frac{0.06}{12}\right)^{3} - 1 = 1.5075\% \)

\[
F = 2000 \ (F \mid P, 1.5075\%, 12)
\]
Equivalence Analysis using Effective Interest Rate

- **Step 1:** Identify the payment period (e.g., annual, quarter, month, week, etc)
- **Step 2:** Identify the interest period (e.g., annually, quarterly, monthly, etc)
- **Step 3:** Find the effective interest rate that covers the payment period.
Principle: Find the effective interest rate that covers the payment period

Case 1: compounding period = payment period

Case 2: compounding period < payment period

Case 3: compounding period > payment period
When Payment Periods and Compounding periods coincide

Step 1: Identify the number of compounding periods \((M)\) per year

Step 2: Compute the effective interest rate per payment period \((i)\)

\[
i = \frac{r}{M}
\]

Step 3: Determine the total number of payment periods \((N)\)

\[
N = M
\]

Step 4: Use the appropriate interest formula using \(i\) and \(N\) above
When Payment Periods and Compounding periods coincide
Payment Period = Interest Period

Given: $P = $20,000, $r = 8.5\%$ per year compounded monthly

Find $A$ (monthly payments)

Step 1: $M = 12$
Step 2: $i = r/M = 8.5\%/12 = 0.7083\%$ per month
Step 3: $N = (12)(4) = 48$ months
Step 4: $A = $20,000\((A/P, 0.7083\%, 48) = $492.97$
What three levels of smokers who bought cigarettes every day for 50 years at $1.75 a pack would have if they had instead banked that money each week:

<table>
<thead>
<tr>
<th>Level of smoker</th>
<th>Would have had</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pack a day</td>
<td>$169,325</td>
</tr>
<tr>
<td>2 packs a day</td>
<td>$339,650</td>
</tr>
<tr>
<td>3 packs a day</td>
<td>$507,976</td>
</tr>
</tbody>
</table>

Note: Assumes constant price per pack, the money banked weekly and an annual interest rate of 5.5%

Source: USA Today, Feb. 20, 1997
Sample Calculation: One Pack per Day

**Step 1:** Determine the effective interest rate per payment period.

Payment period = weekly

“5.5% interest compounded weekly”

\[ i = \frac{5.5}{52} = 0.10577\% \text{ per week} \]

**Step 2:** Compute the equivalence value.

Weekly deposit amount

\[ A = 1.75 \times 7 = 12.25 \text{ per week} \]

Total number of deposit periods

\[ N = (52 \text{ weeks/yr.})(50 \text{ years}) = 2600 \text{ weeks} \]

\[ F = 12.25 \times (F/A, 0.10577\%, 2600) = 169,325 \]
Compounding more frequent than payments
Discrete Case Example: Quarterly deposits with monthly compounding

Suppose you make equal *quarterly* deposits of $1000 into a fund that pays interest at a rate of 12% compounded *monthly*. Find the balance at the end of year three.
Compounding more frequent than payments
Discrete Case Example: Quarterly deposits with monthly compounding

Step 1: \[ M = 12 \text{ compounding periods/year} \]
\[ K = 4 \text{ payment periods/year} \]
\[ C = 3 \text{ interest periods per quarter} \]

Step 2: \[ i = \left[ 1 + 0.12 / (3)(4) \right]^3 - 1 \]
\[ = 3.030\% \]

Step 3: \[ N = 4(3) = 12 \]

Step 4: \[ F = $1,000 \left( F/A, 3.030\%, 12 \right) \]
\[ = $14,216.24 \]
Continuous Case: Quarterly deposits with Continuous compounding

Suppose you make equal \textit{quarterly} deposits of $1000 into a fund that pays interest at a rate of 12\% compounded \textit{continuously}. Find the balance at the end of year three.
Continuous Case: Quarterly deposits with Continuous compounding

Step 1: \( K = 4 \) payment periods/year
\( C = \infty \) interest periods per quarter

Step 2:
\[
i = e^{0.12/4} - 1
\]
= 3.045% per quarter

Step 3: \( N = 4(3) = 12 \)

Step 4:
\[
F = \$1,000 \left( F/A, 3.045\%, 12 \right)
\]
= \$14,228.37
Suppose you make $500 \textit{monthly} deposits to an account that pays interest at a rate of 10\%, compounded \textit{quarterly}. Compute the balance at the end of 10 years.

\[ i = (1 + 0.10/4)^{1/3} - 1 = 0.826\% \text{ per month} \]

\[ F = 500(F \mid A,0.826\%,120) = 101907.89 \]

\[ F = 1500(F \mid A,2.5\%,40) = 101103.83 \]

Whenever a deposit is made, it starts to earn interest.

Money deposited during a quarter does not earn interest.
Credit Card Debt

- Annual fees
- Annual percentage rate
- Grace period
- Minimum payment
- Finance charge

Pay the minimum, pay for years
Making minimum payments on your credit cards can cost you a bundle over a lot of years. Here's what would happen if you paid the minimum—or more—every month on a $2,705 card balance, with a 18.38% interest rate.

<table>
<thead>
<tr>
<th>Payment rate</th>
<th>How long to pay off debt</th>
<th>Interest paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% of balance</td>
<td>27 years, 2 months</td>
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<td>$594</td>
</tr>
</tbody>
</table>

(Source: USA Today, April 21, 1998, © USA Today, used with permission)
### Methods of Calculating Interests on your Credit Card

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Interest You Owe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adjusted Balance</strong></td>
<td>The bank subtracts the amount of your payment from the beginning balance and charges you interest on the remainder. This method costs you the least.</td>
<td>Your beginning balance is $3,000. With the $1,000 payment, your new balance will be $2,000. You pay 1.5% on this new balance, which will be $30.</td>
</tr>
<tr>
<td><strong>Average Daily Balance</strong></td>
<td>The bank charges you interest on the average of the amount you owe each day during the period. So the larger the payment you make, the lower the interest you pay.</td>
<td>Your beginning balance is $3,000. With your $1,000 payment at the 15th day, your balance will be reduced to $2,000. Therefore, your average balance will be $(1.5%)($3,000+$2,000)/2=$37.50$.</td>
</tr>
<tr>
<td><strong>Previous Balance</strong></td>
<td>The bank does not subtract any payments you make from your previous balance. You pay interest on the total amount you owe at the beginning of the period. This method costs you the most.</td>
<td>Regardless of your payment size, the bank will charge 1.5% on your beginning balance $3,000: $(1.5%)($3,000)=$45$.</td>
</tr>
</tbody>
</table>
Commercial Loans

Amortized Loans

- Effective interest rate specified
- Paid off in installments over time (equal periodic amounts)
- What is the cost of borrowing? NOT necessarily the loan with lowest payments or lowest interest rate. Have to look at the total cost of borrowing (interest rate and fees, length of time it takes you to repay (term))
Auto Loan

Given: $APR = 8.5\%$, $N = 48$ months, and $P = $20,000

Find: $A$

$$A = P \times (A/P, 8.5\%/12, 48)$$

$$= $492.97$$
Suppose you want to pay off the remaining loan in lump sum right after making the 25th payment. How much would this lump be?

\[ P = 492.97 \cdot (P/A, 0.7083\%, 23) = 10,428.96 \]
For the 33rd payment, what is the interest payment and principal payment?

\[
492.97(P | A, 8.5\%/12,16) = 7431.12
\]

Remaining balance after 32 payments

\[
7431.12(0.0071) = 52.76
\]

Interest component of the 33rd payment

\[
492.97 - 52.76 = 440.21
\]

Principal payment component of the 33rd payment
# Buying versus Lease Decision

<table>
<thead>
<tr>
<th></th>
<th>Option 1 Debt Financing</th>
<th>Option 2 Lease Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$14,695</td>
<td>$14,695</td>
</tr>
<tr>
<td>Down payment</td>
<td>$2,000</td>
<td>0</td>
</tr>
<tr>
<td>APR (%)</td>
<td>3.6%</td>
<td></td>
</tr>
<tr>
<td>Monthly payment</td>
<td>$372.55</td>
<td>$236.45</td>
</tr>
<tr>
<td>Length</td>
<td>36 months</td>
<td>36 months</td>
</tr>
<tr>
<td>Fees</td>
<td></td>
<td>$495</td>
</tr>
<tr>
<td>Cash due at lease end</td>
<td></td>
<td>$300</td>
</tr>
<tr>
<td>Purchase option at lease end</td>
<td></td>
<td>$8,673.10</td>
</tr>
<tr>
<td>Cash due at signing</td>
<td>$2,000</td>
<td>$731.45</td>
</tr>
</tbody>
</table>
6% compounded monthly
Which Option is Better?

- **Debt Financing:**

  \[
P_{\text{debt}} = 2000 + 372.55(P/A, 0.5\%, 36) - 8673.10(P/F, 0.5\%, 36)
  \]

  \[= 6998.47\]

- **Lease Financing:**

  \[
P_{\text{lease}} = 495 + 236.45 + 236.45(P/A, 0.5\%, 35) + 300(P/F, 0.5\%, 36)
  \]

  \[= 8556.90\]
Example

Suppose you borrowed $10000 at an interest rate of 12% compounded monthly over 36 months. At the end of the first year (after 12 payments), you want to negotiate with the bank to pay off the remainder of the loan in 8 equal quarterly payments. What is the amount of this quarterly payment, if the interest rate and compounding frequency remain the same?
Example Solution

\[ A = 10000(A \mid P, 1\%, 36) = 332.14 \]

Remaining debt (end of 1st) = 332.14(\(P \mid A, 1\%, 24\)) = 7055.77

Effective rate per quarter = \((1 + 0.01)^3 - 1 = 3.03\%\)

\[ A = 7055.77(A \mid P, 3.03\%, 8) = 1006.41 \text{ per quarter} \]
Example

An individual wants to make equal monthly deposits into an account for 15 years in order to then make equal monthly withdrawals of $1500 for the next 20 years, reducing the balance to zero. How much should be deposited each month for the first 15 years if the interest rate is 8% compounding weekly? What is the total interest earned during this 35 year process?
Example

A family has a $30000, 20 year mortgage at 15% compounded monthly.

- Find the monthly payment and the total interest paid.
- Suppose the family decides to add an extra $100 to its mortgage payment each month starting from the first payment of the 6th year. How long will it take the family to pay off the mortgage? How much interest will the family save?
Example

A man borrows a loan of $10000 from a bank. According to the agreement between the bank and the man, the man will pay nothing during the first year and will pay equal amounts of $A$ every month for the next 4 years. If the interest rate is 12% compounded weekly, find

- the payment amount $A$
- The interest payment and principal payment for the 20th payment.
- Suppose you want to pay off the remaining loan in lump sum right after making the 25th payment. How much would this lump be?
Example

A man’s current salary is $60000 per year and he is planning to retire 25 years from now. He anticipates that his annual salary will increase by $3000 each year and he plans to deposit 5% of his yearly salary into a retirement fund that earns 7% interest compounded daily. What will be the amount accumulated at the time of his retirement.
Example

A series of equal quarterly payments of $1000 extends over a period of 5 years. What is the present worth of this quarterly-payment series at 9.75% interest compounded continuously?
Example

A lender requires that monthly mortgage payments be no more than 25% of gross monthly income, with a maximum term of 30 years. If you can make only a 15% down payment, what is the minimum monthly income needed in order to purchase a $200,000 house when the interest rate is 9% compounded monthly?
Example

Alice wanted to purchase a new car for $18,400. A dealer offered her financing through a local bank at an interest rate of 13.5% compounded monthly. The dealer’s financing required a 10% down payment and 48 equal monthly payments. Because the interest rate is rather high, Alice checked with her credit union for other possible financing options. The loan officer at the credit union quoted her 10.5% interest for a new-car loan and 12.25% for a used-car loan. But to be eligible for the loan, Alice had to have been a member of the credit union for at least six months. Since she joined the credit union two months ago, she has to wait four more months to apply for the loan. Alice decides to go ahead with the dealer’s financing and 4 months later refinances the balance through the credit union at an interest rate of 12.25% (because the car is no longer new)

a) Compute the monthly payment to the dealer
b) Compute the monthly payment to the credit union
c) What is the total interest payment for each loan transaction
Example

A loan of $10000 is to be financed over a period of 24 months. The agency quotes a nominal interest rate of 8% for the first 12 months and a nominal interest rate of 9% for any remaining unpaid balance after 12 months, with both rates compounded monthly. Based on these rates, what equal end-of-month payments for 24 months would be required in order to repay the loan?
Example

Suppose you are in the market for a new car worth $18000. You are offered a deal to make a $1800 down payment now and to pay the balance in equal end-of-month payments of $421.85 over a 48 month period. Consider the following situations:

a) Instead of going through the dealer’s financing, you want to make a down payment of $1800 and take out an auto loan from a bank at 11.75% compounded monthly. What would be your monthly payments to pay off the loan in 4 years?

b) If you were to accept the dealer’s offer, what would be the effective rate of interest per month charged by the dealer on your financing?
Example

A man borrowed money from a bank to finance a small fishing boat. The bank’s loan terms allowed him to defer payments for six months and then to make 36 equal end-of-month payments thereafter. The original bank note was for $4800 with an interest rate of 12% compounded weekly. After 16 monthly payments, David found himself in a financial bind and went to a loan company for assistance in lowering his monthly payments. Fortunately, the loan company offered to pay his debts in one lump sum, provided that he pays the company $104 per month for the next 36 months. What monthly rate of interest is the loan company charging on this transaction?