Financial Calculations on the Sharp EL-733A

Converting from APR to EAR

- Consider $1 for 1 year 6% compounded
  - quarterly: 1.5% every quarter for 4 quarters
  - monthly: 0.5% every month for 12 months
  - daily: \((6/365)\)% every day for 365 days

Effective Annual Rate

Quarterly: \( FV = 1 \times (1.015)^4 = 1.06136 \)
EAR = 6.136%

Monthly: \( FV = 1 \times (1.005)^{12} = 1.061678 \)
EAR = 6.1678%

Daily: \( FV = 1 \times (1 + (6/365))^{365} = 1.061831... \)
EAR = 6.1831%

On the Sharp EL-733A

1. Enter the compounding frequency
2. Use the \([\Rightarrow \text{EAR}]\) function
3. Enter the nominal, APR, rate being converted
4. Push the \([=]\) button to get the EAR

Converting from EAR to APR

The account earns an EAR of 6%
- If the account compounds interest quarterly, what is the APR?
- If the account compounds interest monthly, what is the APR?
- If the account compounds interest daily, what is the APR?
### Example

\[
q = \left(1 + \text{EAR}\right)^{\left(\frac{m}{m}\right)} - 1
\]

- Quarterly: \( q = \left(1.06\right)^{\left(\frac{4}{4}\right)} - 1 \)
  \( = 5.8695\% \)
- Monthly: \( q = \left(1.06\right)^{\left(\frac{12}{12}\right)} - 1 \)
  \( = 5.841\% \)
- Daily: \( q = \left(1.06\right)^{\left(\frac{365}{365}\right)} - 1 \)
  \( = 5.8273\% \)

### On the Sharp EL-733A

**To convert from EAR to APR**

1. Enter the compounding frequency
2. Use the \([\rightarrow \text{APR}]\) function
3. Enter the EAR rate being converted
4. Push the \([=]\) button to get the APR

<table>
<thead>
<tr>
<th>Frequency</th>
<th>EAR Rate</th>
<th>APR Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly</td>
<td>5.8695%</td>
<td>5.8695%</td>
</tr>
<tr>
<td>Monthly</td>
<td>5.841%</td>
<td>5.841%</td>
</tr>
<tr>
<td>Daily</td>
<td>5.8273%</td>
<td>5.8273%</td>
</tr>
</tbody>
</table>

### Mortgage Example

- \$120,000 principal (=PV)
- 25 year amortization (n=300 months)
- 8% five year term
- EAR=8.16\%
- APR=7.87\%
- monthly=0.655819\%...

### Solution

\[
PV = C(PV_{A_{25\text{ mon}}})
\]

\[
120,000 = C(PV_{A_{0.0816\%},300})
\]

\[
C = \frac{120,000}{PV_{A_{0.0816\%},300}}
\]

\[
= \frac{120,000}{131.024343...} = \$915.86
\]

### On the Sharp EL-733A

**To do mortgage calculations**

1. Calculate the EAR and store in memory
2. Calculate the APR rate
3. Divide by 12 and enter result as the \([i]\)
4. Enter the number of payments as the \([n]\)
5. Enter the principal as the \([PV]\)
6. Compute the payment \([\text{COMP}]\text{[PMT]}\)

MORE TO COME, DO NOT CLEAR
On the Sharp EL-733A

- 2nd F =>EFF
- 8 ➥ 
- 8.16 ➥ M
- 12 ➢ 2nd F ➢ APR
- RM ➥ 7.869836
- DIV ➥ 12 ➵ 0.655822 i
- 25 ➥ X ➵ 12 ➥ 300 n
- COMP PMT ➥ - $915.86

Renewal Balance

- The principal of a mortgage is always the PV of the payments that remain on the amortization
- After 5 years:
  \[ \text{BAL}_{60} = \$915.86 \left( \text{PVA}_{0.6558119\%, 240} \right) \]
  \[ = \$915.86(120.720826...) \]
  \[ = \$110,563.38 \]

Other Questions

- Principal $120,000.00
- At Renewal 110,563.38
- Principal Paid 9,436.62
- Interest Paid 45,514.98
- Total Paid 54,951.60

On the Sharp EL-733A

- The “AMRT” key gives us the amortization table
- The following slide illustrates the amortization function for the first two payments

- We can jump to any payment
- this is one of the situations where the calculator takes its time - and appears to die - to do the calculation
On the Sharp EL-733A

Accumulated Values

- On the EL-733A, there are a pair of keys that will allow us to determine how much principal and interest has been paid over a range of periods.
- These are the \([P_1/P_2]\) and \([ACC]\) keys.
- The first time you are telling the 733A the starting payment, the second time, the ending payment.

Accumulated Values

- On the Sharp EL-733A

Buying - Loan

- \$23,500 + 15\% \times \$23,500 - 3,500 = \$23,525
- 4.8\% APR, \(r_{M\text{ON}} = 0.4\%
- Assume a 48 month loan
- \(PVIFA_{0.4,48} = 43.9542\ldots\)

\[
PMT = \frac{\text{Principal}}{PVIFA_{0.4,48}} = \frac{23,525}{43.5942\ldots} = \$539.64
\]

On the Sharp EL-733A

Car Buying or Leasing

- Suppose you have decided on a new Bolero from National Motors. Its total cost before sales taxes (15\%) is \$23,500. You plan to put \$3,500 down regardless whether you lease or buy. The buyback at the end of the 48 month lease is \$9,000. The dealer is offering 4.8\% APR financing and lease rates, both compounded monthly.
Lease

- On the lease, the sales tax does not get financed, but the payments are subject to sales taxes
- The present value of the lease payments, plus the present value of the buyback on the car must equal the cash price of the car
- Lease payments are made in advance, or at the beginning of each month

\[ 20,000 = PMT \left( PVIF_{0.4\%,48} \right) + \frac{9,000}{(1.004)^{48}} \]
\[ = PMT(43.7686...) + 9,000 \times 1.2112... \]
\[ = PMT(43.7686...) + 7,430.61 \]
\[ 12,569.39 = PMT(43.7686...) \]
\[ PMT = 12,569.39 \times \frac{1}{43.7686...} = 287.18 \]

On the EL-733A, Step 1

- 9000 FV
- COMP PV -7,430.61
- 0.400 i
- 48 n

On the EL-733A, Step 2

- This is subtracted from the net purchase price to get the amount financed
- 20,000 - 7,430.61 = 12,569.39

On the EL-733A, Step 2

BGN

- 0 FV
- 12569.39 PV
- COMP PMT -287.18
- 0.40% i
- 48 n

Regular Fixed Coupon Bond

\[ PV = B_0 = \left( PV \right)_{k_B n} + \frac{M}{(1 + k_b)^n} \]

Consider a 9%, 12 yr bond at 7%
\[ B_0 = 45(16.058...) + \frac{1000}{(1.035)^{24}} \]
\[ B_0 = 722.627 + 437.957 = $1,160.58 \]
### On the Sharp EL-733A

<table>
<thead>
<tr>
<th>1000</th>
<th>FV</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP</td>
<td>PV -1,160.58</td>
</tr>
<tr>
<td>45</td>
<td>PMT</td>
</tr>
<tr>
<td>3.500</td>
<td>i</td>
</tr>
<tr>
<td>24</td>
<td>n</td>
</tr>
</tbody>
</table>

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