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 $FV = \$1 * (1.015)^4 = \$1.06136$

EAR = 6.136%

Monthly $FV = \$1 * (1.005)^{12} = \$1.061678$

EAR = 6.1678%

Daily $FV = \$1 * (1 + (6/365))^{365} = \$1.061831...$

EAR = 6.1831%

On the Sharp EL-733A

To convert from a nominal (APR) to EAR

1. Enter the compounding frequency
2. Use the [➜EAR] function
3. Enter the nominal, APR, rate being converted
4. Push the [=] button to get the EAR

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4	2nd F	=>EFF	6	=	6.1364
12	2nd F	=>EFF	6	=	6.1678
365	2nd F	=>EFF	6	=	6.1831

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

$$q = \left((1+\text{EAR})^{(1/m)} - 1\right)m$$

Quarterly $q = \left((1.06)^{(1/4)} - 1\right)4$

$= 5.8695\%$

Monthly $q = \left((1.06)^{(1/12)} - 1\right)12$

$= 5.841...\%$

Daily $q = \left((1.06)^{(1/365)} - 1\right)365$

$= 5.8273...\%$

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To convert from EAR to APR

1. Enter the compounding frequency
2. Use the [➜APR] function
3. Enter the EAR rate being converted
4. Push the [=] button to get the APR

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4	2nd F	=>APR	6	=	5.8695
12	2nd F	=>APR	6	=	5.8411
365	2nd F	=>APR	6	=	5.8274

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

$$PV = C(PVA_{k_{mon},n})$$

$$120{,}000 = C(PVA_{0.6558119\%,300})$$

$$C = \frac{120{,}000}{PVA_{0.6558119\%,300}}$$

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

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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 [COMP][PMT]

MORE TO COME, DO NOT CLEAR

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2	2nd F	=>EFF	8	=	8.16 X=>M
12	2nd F	=>APR	RM	=	7.869836
		DIV	12	=	0.65582 i
	25	X	12	=	300 n
					120000 PV
		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:

$$BAL_{60} = \$915.86(PVA_{0.6558119\%,240})$$
$$= \$915.86(120.720826...)$$
$$= \$110{,}563.38$$

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

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

On the Sharp EL-733A

1	AMRT	-128.87
	AMRT	-786.98
	AMRT	119871.13
2	AMRT	-129.72
	AMRT	-786.14
	AMRT	119741.41

On the Sharp EL-733A

- 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

60	AMRT	-189.52
	AMRT	-726.34
	AMRT	110562.91

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

1	P_1/P_2	
60	P_1/P_2	
	ACC	-9437.09
	ACC	-45514.28

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.

Buying - Loan

- $23,500 + 15%($23,500) - 3,500 = $23,525
- 4.8% APR, r_{MON} = 0.4%
- Assume a 48 month loan
- $PVIFA_{0.4,48}$ = 43,9542...

$$PMT = \frac{\text{Principal}}{PVIFA_{r_{MON},N}} = \frac{23{,}525}{43.5942\ldots} = \$539.64$$

On the Sharp EL-733A

	FV	
23525	PV	
COMP	PMT	-539.64
0.400	i	
48	n	

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

Lease

$$\$20{,}000 = \text{PMT}\left(\text{PVIFAD}_{0.4\%,48}\right) + \frac{9{,}000}{(1.004)^{48}}$$

$$= \text{PMT}(43.7686...) + \frac{9{,}000}{1.2112...}$$

$$= \text{PMT}(43.7686...) + 7{,}430.61$$

$$12{,}569.39 = \text{PMT}(43.7686...)$$

$$\text{PMT} = \frac{12{,}569.39}{43.7686...} = 287.18$$

On the EL-733A, Step 1

9000	FV	
COMP	PV	-7,430.61
	PMT	
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

$$\text{PV} \equiv B_0 = I\left(\text{PVA}_{k_b,n}\right) + \frac{M}{(1+k_b)^n}$$

Consider a 9%, 12 yr bond @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

1000	FV	
COMP	PV	-1,160.58
45	PMT	
3.500	i	
24	n	