# UK APR Examples on the HP-12C

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The last appendix in the HP-12C Owner's Handbook is about UK calculations. In the APR section it mentions that the APR is truncated to one decimal place. Since 14 April 2000 it is in fact rounded, not truncated. In May 2001 the OFT (Office of Fair Trading) put out a booklet numbered OFT144, about Credit Charges and the APR. This is available from www.oft.gov.uk, as oft144.pdf, and is easiest to locate by googling oft144. It gives 8 examples of APR calculations. Here I just want to show how the HP-12C can do them (OFT144 pp32-43 has more details). Lender's advances are shown negative here in TVM and IRR usage (less [CHS] needed<G>).

## Example 1: A single repayment loan

A borrower is lent £1,500 on Friday 14 December 2001 and this is to be repaid by a single instalment of £1,750 on Thursday 22 May 2003. There are no other payments or charges. [f] CLEAR [FIN] [g] [END] [g] [D.MY]

14.122001 [ENTER] 22.052003 [g] [GTO] 10 [R/S] 1500 [CHS] [PV] 1750 [FV] [i] [RCL] 0 [R/S] →11.33775755 ∴APR=11.3 ✓

Lines 10-43 in the program below process the period between the dates. $R_1/R_0 = 52425/36525 = 1.433518275$, the period in years according to OFT. The program puts an appropriate 12C duration (i.e. integral) in both [n] and $R_1$. If the *start date* is the end of February then one day should be added to *both* dates before input. Lines 1-10 do [i]→APR, and just take the number of periods in a year as input. Here we use $36525(=R_0)$ [R/S]; example 2 is semi-annual so we use 2 [R/S]; examples 3-8 are monthly based so we use 12 [R/S] for them.

| Keystrokes | Display | Keystrokes | Display | Keystrokes | Display |
|---|---|---|---|---|---|
| [f] [P/R] | | [g] [ΔDYS] | 15-43 26 | [X] | 31- 20 |
| [f] CLEAR [PRGM] | 00 - | [R↓] | 16- 33 | [RCL] 1 | 32-45 1 |
| [n] | 01- 11 | 3 | 17- 3 | 3 | 33- 3 |
| [RCL] [i] | 02-45 12 | 6 | 18- 6 | 6 | 34- 6 |
| [CHS] | 03- 16 | 0 | 19- 0 | 5 | 35- 5 |
| [PMT] | 04- 14 | [÷] | 20- 10 | 2 | 36- 2 |
| 0 | 05- 0 | [g] [INTG] | 21-43 25 | 5 | 37- 5 |
| [PV] | 06- 13 | [STO] 1 | 22-44 1 | [STO] 0 | 38-44 0 |
| [g] [END] | 07-43 8 | [EEX] | 23- 26 | [X] | 39- 20 |
| [FV] | 08- 15 | 6 | 24- 6 | [+] | 40- 40 |
| [g] [GTO] 00 | 09-43,33 00 | [÷] | 25- 10 | [STO] 1 | 41-44 1 |
| [ENTER] | 10- 36 | [+] | 26- 40 | [n] | 42- 11 |
| [ENTER] | 11- 36 | [x≷y] | 27- 34 | [g] [GTO] 00 | 43-43,33 00 |
| [CLx] | 12- 35 | [g] [ΔDYS] | 28-43 26 | [f] [P/R] | |
| [-] | 13- 30 | [EEX] | 29- 26 | APR = 'Annual | |
| [R↓] | 14- 33 | 2 | 30- 2 | Percentage Rate' | |

## Example 2: A pawnbroking agreement

£1,000 is advanced on a pledge (for example, a piece of jewellery given as security for the loan). The pawnbroker charges interest at 4% a month on a simple interest basis until the pledge is redeemed six months later. Additionally, the pawnbroker charges a £25 administration and storage fee which is deducted from the sum given to the borrower.

[f]CLEAR[FIN] [g][END] 975[CHS][PV] 1240[FV] 1[n] [i] 2[R/S]→ 61.74621959
∴APR=61.7 ✓ Where: 1000[ENTER]25[−]→ 975 & 1000[ENTER] 4[%] 6[X] [+] → 1240

## Example 3: A personal loan

A borrower is advanced £7,500 on 15 August 2000, to be repaid over 48 months by equal monthly instalments. The first instalment is to be paid on 15 November 2000 and the lender requires a £25 administration fee to be paid at the same time. Interest will be charged monthly on the outstanding balance at one-twelfth of the lender's variable annual base rate plus 4%. The base rate is 9.5% at the time the agreement is made.

[f]CLEAR[REG] 7500[CHS][g][CFo] 0[g][CFj]2[g][Nj] 232.67[g][CFj] 207.67[g][CFj]
46[g][Nj] 207.50[g][CFj] [f][IRR] 12[R/S]→ 14.54949424 ∴APR=14.5 ✓

Without admin fee the APR would quite independent of the loan amount and cashflow: [f]CLEAR[FIN] [g][END] 13.5[g][12÷] 12[R/S]→ 14.36744407 ∴APR=14.4

The CFj could have been calculated by the lender thus: [f]CLEAR[FIN] [g][END][f]2
9.5[ENTER]4[+] [g][12÷] 7500[PV] 2 [n][FV]→-7669.70(adjusted advance) [f] [RND]
[PV] 48[n] 0[FV][PMT]→207.67(CF₃) [f][RND][PMT] [FV]→ -.17 [RCL][PMT] [+] →
207.50 (CF₄). CF₂=CF₃+25.

## Example 4: A credit card agreement

● the interest rate is variable and, at the time the agreement is made, the lender's base rate is 14.5% a year;

● an administration fee of £12.50 is charged on the first statement and annually thereafter;

[f]CLEAR[FIN] [g][END]14.5[g][12÷] 12[R/S]→15.50353528 ∴APR=15.5 before taking into account the admin fee. OFT get 16.9 for a hypothetical usage, extending out for 129 months(!). This type of revolving facility is being looked at again. Really they just need to disclose the 15.5 and the fixed admin fee. Much simpler!

## Example 5: An interest-free option deal

An electrical store offers a cooker with a cash price of £495 on a 12 month 'interest-free option' arrangement. The normal terms of the agreement require 36 monthly payments of £21.18 commencing one year after the agreement is made. However, if the borrower pays back the cash price of the goods, either in instalments or in a lump sum, before the payments are due to start no interest will be charged.

⟨f⟩⟨CLEAR⟩⟨REG⟩ 495⟨CHS⟩⟨g⟩⟨CFo⟩ 0⟨g⟩⟨CFj⟩11⟨g⟩⟨Nj⟩ 21.18⟨g⟩⟨CFj⟩36⟨g⟩⟨Nj⟩ ⟨f⟩⟨IRR⟩ 12 ⟨R/S⟩→ 19.80572921 ∴APR=19.8 ✓

## Example 6: An 'option' hire-purchase agreement

A car with a cash price of £9,750 is sold to a borrower under a hire-purchase agreement. The borrower is required to pay a deposit of £975 and the balance (9750⟨ENTER⟩ 975⟨−⟩→ 8775) is to be repaid by 36 monthly instalments. Interest is charged at an ***annual flat rate*** of 5½% and we assume the borrower pays a final lump-sum of £2,975 one month after the final instalment to purchase the car.

⟨g⟩⟨END⟩⟨f⟩2 1⟨n⟩ 5.5⟨ENTER⟩3⟨X⟩⟨i⟩ 8775⟨ENTER⟩2975⟨+⟩⟨CHS⟩⟨PV⟩⟨g⟩⟨LSTx⟩⟨ENTER⟩⟨+⟩⟨FV⟩ ⟨PMT⟩36⟨÷⟩→214.97⟨f⟩⟨RND⟩⟨PMT⟩ 37⟨n⟩ 8775⟨CHS⟩⟨PV⟩ 2975⟨RCL⟩⟨PMT⟩⟨−⟩⟨FV⟩ ⟨i⟩ 12⟨R/S⟩→10.98095539 ∴APR=11.0 ✓

OFT144 page 40 has 214.94 for the instalment, instead of 214.97, derived by way of typo as (1938.75+8775−2975)/36, which doesn't affect the APR, but adds 1.08 to the TAP, which I am sure they will fix one day. Their TCC of 1938.75 should also probably be recalculated as 1938.92 = 36∗214.97 + 2975 − 8775.

## Example 7: A repayment mortgage

A borrower is loaned £78,000 to purchase a home using a repayment mortgage. The loan is to be repaid over 25 years by monthly instalments. The lender requires the borrower to pay a total of £445 as an initial fee. The lender charges interest at its variable base rate using *'annual rests'*. At the time the agreement is made the base rate is 7½% but this is reduced to a fixed 'low-start' rate of 5% for the first two years.

⟨f⟩⟨CLEAR⟩⟨REG⟩ 77555⟨CHS⟩⟨g⟩⟨CFo⟩ 461.19⟨g⟩⟨CFj⟩24⟨g⟩⟨Nj⟩ 575.64⟨g⟩⟨CFj⟩ 99⟨g⟩⟨Nj⟩ ⟨x⋛y⟩⟨g⟩⟨CFj⟩⟨x⋛y⟩⟨g⟩⟨Nj⟩⟨x⋛y⟩⟨g⟩⟨CFj⟩78⟨g⟩⟨Nj⟩

⟨f⟩⟨IRR⟩ 12 ⟨R/S⟩→ 7.425883561 ∴APR=7.4 ✓

The CFj are calculated as follows: 78000⟨ENTER⟩ 445⟨−⟩→ 77555(-CF$_0$)

⟨f⟩⟨CLEAR⟩⟨FIN⟩ ⟨g⟩⟨END⟩ ⟨f⟩2 25⟨n⟩ 5⟨i⟩ 78000⟨CHS⟩⟨PV⟩ ⟨PMT⟩ 12⟨÷⟩ →461.19 (CF$_1$)
2 ⟨f⟩⟨AMORT⟩ 23⟨n⟩ 7.5⟨i⟩ ⟨PMT⟩ 12⟨÷⟩ →575.64(CF$_2$=CF$_3$=CF$_4$ :N=276=99+99+78)

## Example 8: An endowment mortgage

A mortgage is provided on similar terms as those described in Example 7 above, but under an endowment mortgage arrangement. The borrower (*not* lender as in OFT144 p42) is required to maintain an endowment policy and also take out payment protection insurance (PPI) costing £8.50 a month.

⟨f⟩⟨CLEAR⟩⟨REG⟩ 77555⟨CHS⟩⟨g⟩⟨CFo⟩ 333.5⟨g⟩⟨CFj⟩24⟨g⟩⟨Nj⟩ 496⟨g⟩⟨CFj⟩99⟨g⟩⟨Nj⟩ ⟨x⋛y⟩⟨g⟩⟨CFj⟩⟨x⋛y⟩⟨g⟩⟨Nj⟩⟨x⋛y⟩⟨g⟩⟨CFj⟩77⟨g⟩⟨Nj⟩78496⟨g⟩⟨CFj⟩

⟨f⟩⟨IRR⟩ 12⟨R/S⟩→ 7.524614681 ∴APR=7.5 ✓

CF$_5$=78496=78000+CF$_4$ and CF$_1$ and CF$_2$ =CF$_3$=CF$_4$ are calculated as follows:

⟨g⟩⟨END⟩(actually set for all examples here, so it needn't really be repeated<G>)

1⟨n⟩78000⟨CHS⟩⟨PV⟩⟨CHS⟩8.5⟨−⟩⟨FV⟩ 5⟨g⟩⟨12÷⟩⟨PMT⟩→333.5, 7.5⟨g⟩⟨12÷⟩⟨PMT⟩→496