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ANNUITY DUE AND PRESENT VALUE

GENERAL

Data entry sequences for the HP-80 top row keys (`n` `i` `PMT` `PV` `FV`) were designed to be simplest for calculations involving ordinary annuities. The most common definition of *ordinary annuity* (sometimes called "payments in arrears") assumes that payment amounts are equal, that payment periods are equally spaced in time, and that these payments are made *at the end* of each period. However, by slightly modifying the standard key sequences, the HP-80 can be used for *annuity due* calculations (sometimes called "payments in advance") where equal payments are made *at the beginning* of equally spaced periods.

This issue of the HP-80 APPLICATION NOTES will be of assistance to the HP-80 user wishing to solve for *present value, payment amount,* number of *payment periods,* and *interest rate* in annuity due calculations.

The symbolic values listed below will be used to demonstrate the various keystroke sequences that follow.

A = number of payment periods in a year
B = number of years
C = annual interest rate or annual yield (expressed as a %)
D = payment amount
E = present value of a series of payments

FIND THE PRESENT VALUE OF A SERIES OF PAYMENTS

Keystrokes:

1. A `STO` `SAVE ↑` B `×` `n`
2. C `RCL` `÷` `STO` `i`
3. D `RCL` `%` `+` `PMT`
4. `PV` ————————————————————————————————→ E

Example:

The owner of a downtown parking lot has been able to achieve full occupancy and a 7% annual yield (C) by renting parking spaces for $40 (D) per month (A = 12), payable in advance. Some regular customers have expressed interest in renting their spaces on an annual basis. What minimum annual (B = 1) rent, also payable in advance, will maintain his 7% annual yield rate?

Procedure:

12 `STO` `SAVE ↑` 1 `×` `n` 7 `RCL` `÷` `STO` `i` 40 `RCL` `%` `+` `PMT` `PV` ———→ 464.98
(he should charge $464.98 annually)

FIND THE PERIODIC PAYMENT AMOUNT

Keystrokes:

1.   A `STO` `SAVE ↑` B `×` `n`
2.   C `RCL` `÷` `STO` `i`
3.   1 `RCL` `%` `+` E `x≷y` `÷` `PV`
4.   `PMT` ──────────────────────────────► D

Example:

The owner of a piece of equipment presently worth $70,000 (E) intends to lease the equipment for a 5 year period (B). He estimates that the equipment will have no salvage value at the end of the lease, and he desires a 7% annual yield (C). What should the quarterly payments (A = 4) be, assuming that payments are made at the beginning of each quarter?

Procedure:

4 `STO` `SAVE ↑` 5 `×` `n` 7 `RCL` `÷` `STO` `i` 1 `RCL` `%` `+` 70000

`x≷y` `÷` `PV` `PMT` ──────────────────────────────► 4106.52

                                           ($4106.52 per quarter)

FIND THE NUMBER OF PERIODS

Keystrokes:

1.   C `SAVE ↑` A `÷` `STO` `i`
2.   D `RCL` `%` `+` `PMT`
3.   E `PV`
4.   `n` ──────────────────────────────► A×B

Example:

The owner of the equipment in the previous example feels that it would be better if the quarterly payments (A = 4) on the $70,000 (E) piece of equipment were $3,600 (D). How long would he have to lease the equipment if he still desires a 7% annual yield (C).

Procedure:

7 `SAVE ↑` 4 `÷` `STO` `i` 3600 `RCL` `%` `+` `PMT` 70000 `PV` `n`   23.47

                                       (23.47 quarters)

4 `÷` ──────────────────────────────► 5.87

                                       (almost 6 years)

FIND THE ANNUAL INTEREST RATE OR YIELD

Keystrokes:

1.   A `SAVE ↑` B `×` 1 `−` `n`
2.   D `SAVE ↑` `PMT`
3.   E `x≷y` `−` `PV`
4.   `i` A `×` ──────────────────────────────► C

Example:

A term insurance policy may be paid in two ways. The policy holder may pay $1000 (E) at the beginning of each year (B = 1) or he may elect to make payments of $84.87 (D) at the beginning of each month (A = 12). What is the apparent annual interest rate the insurance company is using when converting from annual payments to monthly payments?

Procedure:

12 `SAVE ↑` 1 `×` 1 `−` `n` 84.87 `SAVE ↑` `PMT` 1000 `x≷y` `−` `PV` `i` 12 `×` ──────► 4.01

                                                           (4.01%)