Sinclair Cambridge Programmable

Works out mortgage repayments
Solves quadratic equations
Calculates linear regression
Helps design a twin-T filter
Plays a lunar landing game!

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London Rd
St Ives
Huntingdon
Cambs  PE17 4HJ
part no. 48584 430
sinclair
We've written programs in the Sinclair Program Library to cover a very wide variety of subjects; we'd very much like to hear about any other interesting programs you've written for your Sinclair Cambridge Programmable. By sending in your own program you will become a member of the Sinclair Programmable Users' Library; we'll keep you in touch with news on the other programs in the Users' Library so you can get even better use of your Sinclair Cambridge Programmable.

Send your programs to Users' Library, Sinclair Radionics Limited, London Road, St Ives, Huntingdon, Cambs PE17 4HJ.

To solve hundreds of problems in finance, mathematics, statistics, physics, engineering and electronics, we've written 294 programs specially for the Sinclair Cambridge Programmable. There are 12 samples in this booklet — the rest are all in the Sinclair Program Library.

Before you try any of the programs, familiarise yourself with the calculator by working through the Instruction Booklet enclosed. You'll then be able to use the programs quickly and easily.

Remember these are only sample programs reproduced half size — the full Sinclair Program Library is available from Sinclair Radionics Limited, London Road, St Ives, Huntingdon, Cambridgeshire PE17 4HJ, for £1.95 per volume, or £4.95 for all four volumes.

Whatever your speciality, the program library will make the Sinclair Cambridge Programmable the specialist calculator for you!
HOW TO USE THIS PROGRAM

Day of the week of Christmas Day (program on facing page)

Starting the program

Press  

Display  

0.0000 00

(continued on next page)

Now press the sequence of keys in the program as shown in the first column on the facing page.

Press  

Display  

0.0000 00

0.0000 01

0.0000 02

0.0000 03

0.0000 04

0.0000 05

0.0000 06

0.0000 07

0.0000 08

0.0000 09

0.0000 10

0.0000 11

0.0000 12

0.0000 13

0.0000 14

0.0000 15

0.0000 16

0.0000 17

0.0000 18

0.0000 19

0.0000 20

0.0000 21

0.0000 22

0.0000 23

0.0000 24

0.0000 25

0.0000 26

0.0000 27

0.0000 28

0.0000 29

0.0000 30

0.0000 31

0.0000 32

0.0000 33

0.0000 34

0.0000 35

Stop  

The last step has brought you back to step 00 which shows the check symbol for X (the first step) i.e., on the left of the display.

As you are already at step 00 there is no need to press

(continued on next page)

but you need to do this if you finish at any other step number.
Checking the program

Press | Display
--- | ---
| | .0000 00
 AV CV | 3.0000 01
 AV CV | 1.0000 02
 AV CV | -0.0000 03
 AV CV | 0.0000 34
 AV CV | -.0000 35

At each step, the check symbol on the left of the display should correspond with the check symbols shown in the second column on the program.

If you entered the program correctly, press

AV CV 2 0 0

and you are ready to execute the program.

If you made an error at any stage in the program, read the section on correcting the program on page 19 of the instruction booklet.

Executing the program

Example

Press | Display
--- | ---
| | 1977
 1 9 7 7 | 1


---

**BALANCE OUTSTANDING ON A MORTGAGE**

Given:

- Amount of original mortgage
- Monthly repayment
- Number of years since mortgage was originally taken out
- Rate of interest

Finds:

- Balance

Execution:

- rate / RUN / number of years / RUN / monthly repayment / RUN / original amount / RUN / balance

Example:

I bought a house seven years ago and took out a mortgage for £5500 at 11.5% interest. My monthly repayment has been £70. I now want to sell my house and pay off the mortgage. How much will I have to pay?

Rate | 1 1 5 RUN
--- | ---
Number of years | 7 RUN
Monthly payment | 7 0 RUN
Original amount | 5 5 0 0 RUN
Balance = £3438

Gain | 3.01
1 1.02
0 | 0.03
0 | 0.04
= | 0.06
sto | 2 06
+ | E 07
| 3 08
1 | 1 09
= | 10
| 4 11
X | 12
stop | 0 13
= | 14
V | A 15
e^x | 4 16
X | 17
| 6 18
stop | 0 19
X | 20
| 3 21
1 | 1 22
2 | 2 23
| G 24
rcl | 5 25
= | 26
sto | 2 27
+ | E 29
stop | 0 30
+ | E 32
rcl | 5 33
= | 34
stop | 0 35
CONVERSIONS

1. Convert to feet and inches

PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

Given any $\alpha$ with $0 < \alpha < 0.5$, finds $x$ to within about 2 sig. fig. so that the probability that a standard normal random variable exceeds $x$ is $\alpha$.

Execution:

$$\alpha / \text{RUN} / x$$

For greater accuracy (-1% error) divide result by 1-006.

For still greater accuracy use execution sequence

$$\alpha / X / 1.0007 / \text{RUN} / \div / 1.006 / \div / x$$

Note: This program may take some time to execute.
HYPERBOLIC FUNCTIONS

All the hyperbolic functions

\[ e^x, \cosh x, \sinh x, \tanh x, \coth x, \text{sech} x, \text{csch} x \]

**Execution:**

\[
\begin{align*}
+ & 4 \text{ RUN } \sinh x \text{ RUN } / \\
+ & 5 \text{ RUN } / \cosh x \text{ RUN } / \\
+ & 6 \text{ RUN } / \tanh x \text{ RUN } / \\
+ & 7 \text{ RUN } / \coth x \text{ RUN } / \\
+ & 8 \text{ RUN } / \text{sech} x \text{ RUN } / \\
+ & 9 \text{ RUN } / \text{csch} x \text{ RUN } / \\
+ & 0 \text{ RUN } / \text{cosh} x \text{ RUN } / \\
\end{align*}
\]

**Range:**

\[1 \times 10^{-4} \leq |x| \leq 7.8566\]

---

QUADRATIC EQUATIONS

\[ ax^2 + bx + c = 0 \]

Roots \( x_1, x_2 \) if real

\[ R \pm i \text{ if complex} \]

**Execution:**

\[
\begin{align*}
+ & 0 \text{ RUN } / \pm \text{ RUN } / \\
+ & 1 \text{ RUN } / \text{csc} \text{ RUN } / \\
+ & 2 \text{ RUN } / \text{sec} \text{ RUN } / \\
+ & 3 \text{ RUN } / \text{tan} \text{ RUN } / \\
+ & 4 \text{ RUN } / \text{cot} \text{ RUN } / \\
\end{align*}
\]

* error symbol displayed

After the sequence \( a \text{ RUN } / b \text{ RUN } / c \text{ RUN } / \)

**RUN**/ the display shows *either* (if the roots are real)
the larger real root with no error indication
*or* (if the roots are complex) the imaginary part
and the error symbol. Continue with the
appropriate execution sequence.

The error symbol will tell you whether the roots
are complex. The sequence \(/ \text{RUN} \text{ RUN } / \text{csc} / \)
shown above after \( (x_2) \) is necessary before
entering a new equation to be solved.
CIRCLES

Ground distance and time

\[ \begin{array}{c|c|c|c|c|c|c} 
X & 0.00 \\
6 & 0.01 \\
2 & 0.03 \\
A & 0.04 \\
8 & 0.07 \\
3 & 0.08 \\
1 & 0.09 \\
9 & 0.10 \\
1 & 0.11 \\
6 & 0.12 \\
G & 0.14 \\
3 & 0.16 \\
2 & 0.17 \\
0 & 0.18 \\
A & 0.19 \\
2 & 0.20 \\
0 & 0.21 \\
0 & 0.22 \\
23 & \\
24 & \\
25 & \\
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27 & \\
28 & \\
29 & \\
30 & \\
31 & \\
32 & \\
33 & \\
34 & \\
35 & \\
\end{array} \]

PROJECTILES

Position relative to point of projection after time \( t \)

\[ \begin{align*} 
x &= v_0 t \cos \theta \\
y &= v_0 t \sin \theta - \frac{gt^2}{2} 
\end{align*} \]

Execution:

\[ \begin{align*} 
\theta^2 & / \text{RUN} / v_x & / \text{RUN} / t & / \text{RUN} / \sqrt{} & / \text{RUN} / \sqrt{} \\
\text{In S.I. units; } g \text{ taken as } 9.81 \text{ms}^{-2}. 
\end{align*} \]
RELATIVITY

Fitzgerald contraction, time dilation and mass change.

\[ T' = T \left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}} \]
\[ L' = L \left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}} \]
\[ M' = M \left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}} \]

Execution:
(i) v / RUN / c / RUN / T / X / RUN / T'
(ii) v / RUN / c / RUN / L / X / RUN / L'
(iii) v / RUN / c / RUN / M / ÷ / RUN / M'

BEAM BENDING

Beam with one fixed end and load W at free end

end slope = \( \frac{Wl^2}{2EI} \)
end deflection = \( \frac{Wl^3}{3EI} \)

Execution:
\$ / RUN / W / RUN / E / RUN / I / RUN / slope / RUN / deflection \$
**RESISTORS IN PARALLEL**

(capacitors in series)

(Inductors in parallel)

(Conductors in series)

Pre-execution:

\[ R_1 / \text{RUN} / R_2 / \text{RUN} / \frac{R_1 R_2}{R_1 + R_2} \]

Execution:

\[ R_1 / \text{RUN} / R_2 / \text{RUN} / R_3 / \cdots / R_n / \text{RUN} / \text{Replaced} \]

Alternative execution:

To find resistor \( R_2 \) required to make parallel combination of \( R_1 \) and \( R_2 = R \):

\[ R / \text{RUN} / R_1 / \# / \text{RUN} / \text{RUN} / R_2 \]

\( R_1 \) must be greater than \( R \)

---

**LATTICE ATTENUATOR SECTIONS**

\[ R_1 \rightarrow R_2 \rightarrow R_0 \]

(\( R_0 \) must be balanced, constant impedance)

\[ a_v = a, \quad A = -20 \log a \]

Characteristic impedance = \( R_0 \)

\[ R_1 = \frac{1 - a}{1 + a}, \quad R_2 = \frac{1 + a}{1 - a} R_0 \]

Execution:

\[ \# / \# / \text{RUN} / 1 / 3 / a / \text{RUN} / R_0 / \text{RUN} / R_2 / \text{RUN} / R_1 \]

or

\[ / A / \text{RUN} / R_0 / \text{RUN} / R_2 / \text{RUN} / R_1 \]

---

\[ - F \quad 00 \]

\[ \# \quad 3 \quad 02 \]

\[ 8 \quad 8 \quad 03 \]

\[ - A \quad 04 \]

\[ 6 \quad 6 \quad 05 \]

\[ 8 \quad 8 \quad 06 \]

\[ 5 \quad 5 \quad 07 \]

\[ 8 \quad 8 \quad 08 \]

\[ 9 \quad 9 \quad 09 \]

\[ = \quad 10 \]

\[ \# \quad 3 \quad 14 \]

\[ 1 \quad 1 \quad 15 \]

\[ \# \quad 6 \quad 17 \]

\[ - F \quad 18 \]

\[ 2 \quad 2 \quad 20 \]

\[ - F \quad 21 \]

\[ 6 \quad 22 \]

\[ X \quad 23 \]

\[ \# \quad 3 \quad 19 \]

\[ 2 \quad 24 \]

\[ = \quad 26 \]

\[ = \quad 30 \]

\[ = \quad 31 \]

\[ = \quad 32 \]

\[ = \quad 33 \]

\[ = \quad 34 \]

\[ = \quad 35 \]
Sample from Volume 4

LINEAR CIRCUIT THEORY

Simple L-R or C-R circuit

\[ \tau = CR \quad \text{or} \quad \tau = \frac{L}{R} \]

Charge: \( V_C(t) = V_0 (1 - e^{-\frac{t}{\tau}}) \)

Discharge: \( V_C(t) = V_0 e^{-\frac{t}{\tau}} \)

Pre-execution:

\[ R / X / C = / \rightarrow / sto / \quad \text{or} \]

\[ L / \div / R = / \rightarrow / sto / \quad \text{or} \]

\[ \tau / \rightarrow / sto / \rightarrow / sto / \rightarrow / goto / 0 / 0 / \]

Execution:

\[ t / RUN / V_C / RUN / V_C(t) \]

Send for your Sinclair Program Library — now!

All four volumes of the Sinclair Program Library contain programs designed specifically for use with the Sinclair Cambridge Programmable.

Each volume adopts the same, easy-to-follow layout as this sample, using the same keyboard vocabulary.

The Sinclair Program Library is available to you for £4.95 — or £1.95 for each of the four volumes.

This is how the library is arranged:

Vol. 1: General, Finance, Statistics
Vol. 2: Mathematics, Geometry
Vol. 3: Physics, Engineering
Vol. 4: Electronics

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