Hewlett-Packard Calculators

Bruce Horrocks | ConTeXt Meeting 2024

Warning...

… calculator collectors hold conferences as well

Florida, USA

London (in 2023 at POSK, the Polish Cultural Centre)

Allschwil, Switzerland

A selective history of Hewlett-Packard's electronic calculators

HP 9100A

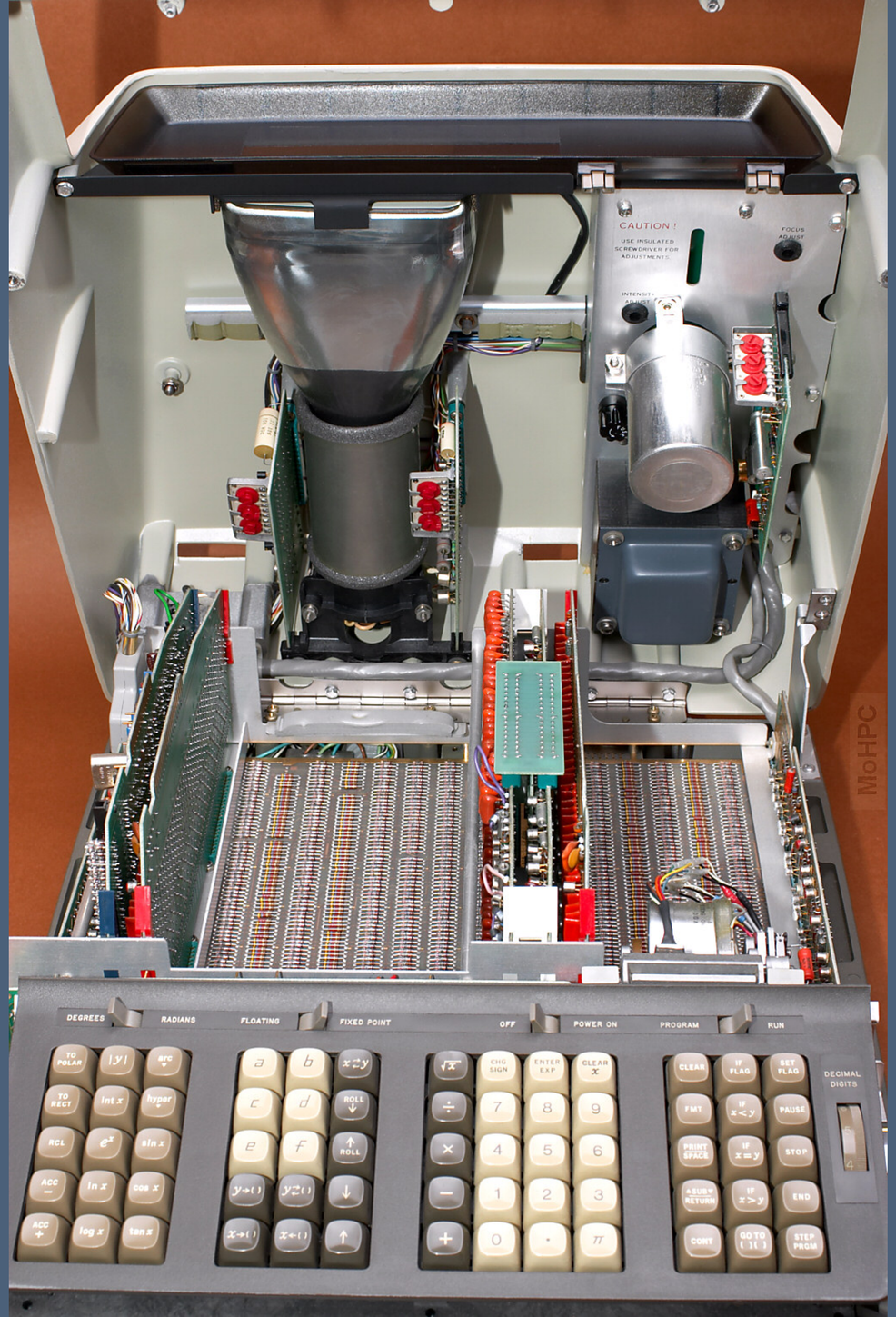
1968

- discrete logic (no integrated circuits)
- range 10^{-98} - 10^{98}, 10-digits displayed, 12 internally
- programmable, RPN 3 level stack
- tour-de-force of technology for the day (that I won't be able to do justice to)

HP 9100A

internals easily accessible

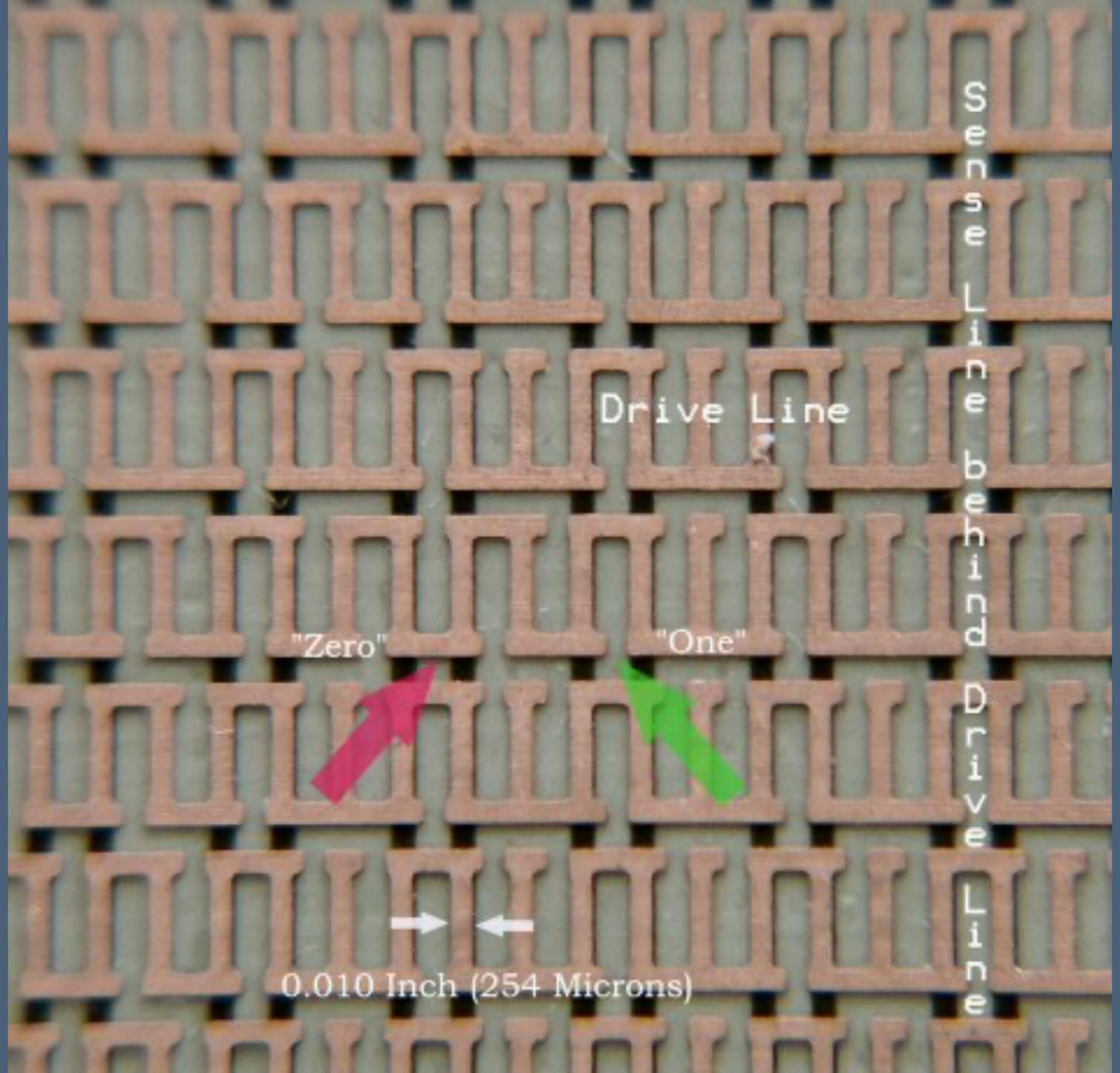
- resistor-diode logic
- bit-serial processor
- ROM provided by a 16-layer, inductively coupled circuit board
- RAM was magnetic core memory
- additionally, rope magnetic core ROM was used to expand 6-bit instructions to 29-bit microcode
- very fast for the day – 1.21 MHz clock and could add/subtract two FP numbers in 2ms



HP 9100A

inductively coupled ROM

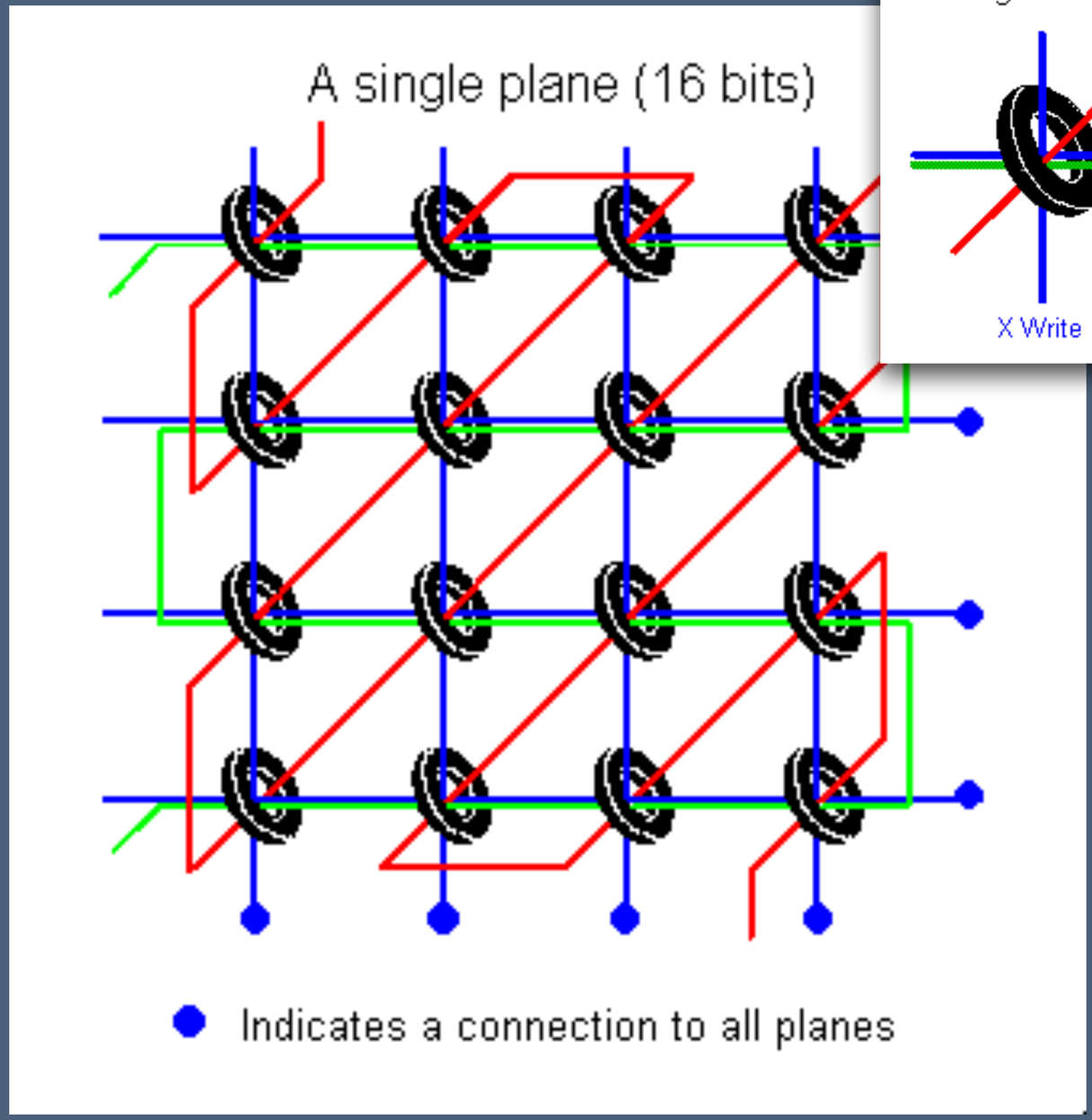
- The HP 9100 contained 32K bits (512 64-bit words) of ROM program memory. The program ROM was built on a 16-layer printed circuit board and achieved a density of 1000 bits per square inch.
- Pulses were sent down two lines and were inductively coupled on a sense line. Signals from the two lines either reinforced or canceled each other producing a 1 or 0 on the sense line.
- 64 sense amplifier/latch circuits read the results and in turn drove the calculator's logic circuits



HP 9100A

magnetic core memory

- read/written by sending small current through X & Y. At the intersection there is enough to set the polarity
- if setting the polarity causes a change then a current is induced in the sense wire
- planes connected to reduce no. of addressing circuits but then an inhibit line is needed



HP 9100A

James van Allen

Dr. Van Allen relied on an HP 9100A and its optional plotter to study the feasibility of using a gravity slingshot around Jupiter to allow Pioneer 11 to intercept Saturn. Pioneer 11 was retasked and arrived at Saturn before Voyager 1.

HP 35

1972

- shirt-pocket sized HP 9100
- “the bug” - 2.02 ln e^x → 2.0
- red dot

HP 34C

1979

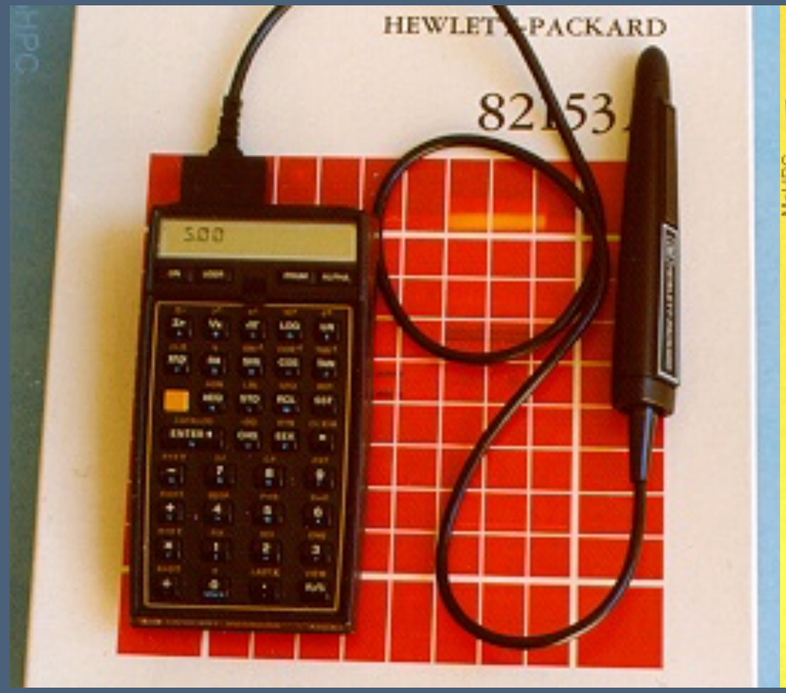
- solve & integrate
- implement *f(x) = 0* as a program then solve
- or *y = f(x)* and integrate

HP 41C

1979 - 1990

- 1st alpha-numeric
- plug-in modules
- huge range of peripherals

Peripherals



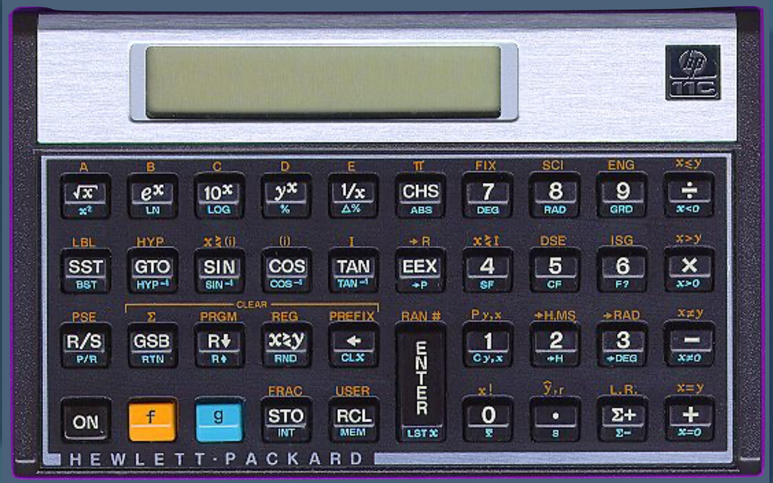
Landscape models

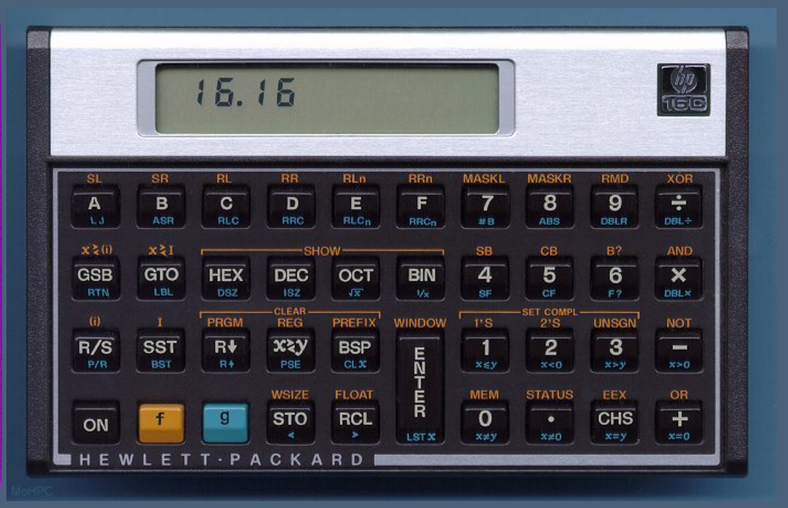
HP 12C

1981 - present day!

- Financial model
- RPN only
- at least 8 circuit board revisions over time as chip fab technology has moved on
- one of a range of landscape models

Scientific and computer scientist models as well...





An aside

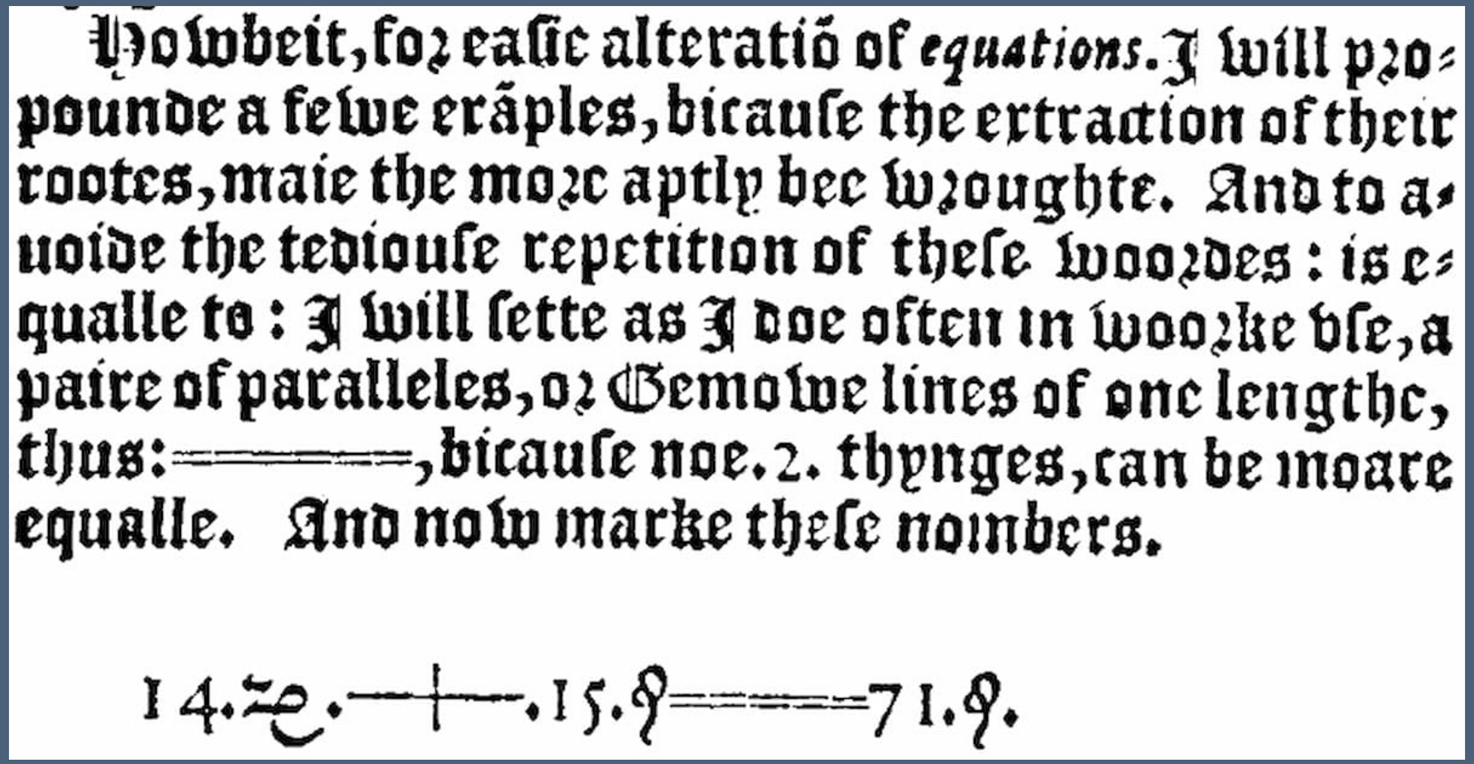
RPN v Algebraic entry

$$\frac{4+5}{6+7}$$

- algebraic – origins lost but it's what you are taught at school
- parentheses needed to ensure correct order
- (4 + 5) ÷ (6 + 7) =
- 12 keystrokes

- RPN – Reverse Polish Notation – invented by Jan Łukasiewicz
- operators follow arguments
- 4 enter 5 + 6 enter 7 + ÷
- 9 keystrokes

The equals sign



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"Because noe 2 thynges can be moare equalle."
– The Whetstone of Witte, Robert Recorde, 1557

CAS and beyond RPN

HP's RPL language powered a long-running series of scientific graphing models

HP Prime

2013

- 32 MB RAM / 256 MB Flash (model G1)
  256 MB / 512 MB (model G2)
- primarily algebraic
- Home and CAS modes plus Apps
- exam mode
- Programmed using HP's own language - cross between basic & Pascal
- Half-supports Python

Copies & clones

Victor V12

HP-12C clone

- Uses 2xAAA batteries so one set will last a lifetime (almost literally).
- The display is tilted up towards the user which makes it more easily read when flat on a desk.

SwissMicros.com have made an entire range of clones, both original and credit-card sized

Credit-card sized 15C

DM42 – an HP-42S clone

DM32 – an HP-32Sii clone