POLYROOT and NTHROOT for HP-49G/49G+

1 Introduction

POLYROOT finds roots of a polynomial with degree< 5. NTHROOT calculates n-th root of a complex number with a integer n. In some case, this can be used instead of XROOT. The library ID is 786.

2 Files

`polyroot.hp`	Library file for HP-49G/49G+
`readme.pdf`	This file

3 Version

Ver1.00 :	2006.5.9	First release
Ver1.01 :	2006.5.10	A bug of sign of roots is fixed.

4 Installation

1. Transfer the file `polyroot.hp` to the calculator.
2. Using the filer of HP-49G/49G+, move the file to PORT2 or PORT1. (PORT2 is recommended.)
3. Holding ON-key and press C-key.
4. After boot up, the library can be used.

If you find any problems, please let me know in comp.sys.hp48 or by E-mail (qqvv6t89@io.ocn.ne.jp).

5 Commands

POLYROOT

Find the roots of a polynomial. In POLYROOT, Cardano formula and Ferrari formula are simply applied without simplification of roots. Therefore the output is complicated and useless in many cases. If you can, the polynomial should be factored by `FACTOR` or `FACTORS` before applying POLYROOT, then you can get simple answer in some case.

In the output, there may be terms as $e^{i\mathrm{ATAN}(a)/n}$ with real number a. Since $1 + ai = \sqrt{1+a^2}e^{i\mathrm{ATAN}(a)}$, we get $e^{i\mathrm{ATAN}(a)/n} = \sqrt[n]{\frac{1+ai}{\sqrt{1+a^2}}}$. However, the left hand side is uniquely defined, but the right hand side is not uniquely defined. Furthermore, the command →`NUM` cannot be applied for the expression of the right hand side. Therefore, POLYROOT and NTHROOT use expressions with ATAN. If you do not prefer this, substitute the right hand side for the left hand side by ATAN2ROOT.

Input	Level 1/Argument 1	a ploynomial of degree ≤ 4
Output	Level 1/Argument 1	a list of roots

e.g.

Input	Level 1/Argument 1	$X^3 + X + 1$
Output	Level 1/Argument 1	$\{\sqrt[3]{\frac{-9+\sqrt{93}}{18}} + \frac{\frac{-1}{3}}{\sqrt[3]{\frac{-9+\sqrt{93}}{18}}}, \ldots\}$ (exact mode) $\{(-.6823\ldots, 0.), \ldots\}$ (approx. mode)

NTHROOT

n-th root of a complex number. There are n answers for n-th root. NTHROOT chooses a simple expression. The output may not be primitive. This command uses the built-in command ARG.

Input	Level 2/Argument 1	a : a complex number
	Level 1/Argument 2	n : a positive integer
Output	Level 1/Argument 1	$\sqrt[n]{a}$

e.g.

Input	Level 2/Argument 1	$1 + i$
	Level 1/Argument 2	3
Output	Level 1/Argument 1	$-\frac{(1-i)\sqrt{2}\sqrt[3]{\sqrt{2}}}{2}$

Input	Level 2/Argument 1	i
	Level 1/Argument 2	3
Output	Level 1/Argument 1	$-i$

Input	Level 2/Argument 1	$1 + i$
	Level 1/Argument 2	6
Output	Level 1/Argument 1	$\sqrt[6]{\sqrt{2}}e^{\frac{3i\pi}{8}}$

ATAN2ROOT

See POLYROOT. Substitution is done by the built-in command ↓MATCH.

Input	Level 1/Argument 1	a list of complex numbers
Output	Level 1/Argument 1	a list of complex numbers

Input	Level 1/Argument 1	a complex number
Output	Level 1/Argument 1	a complex number

e.g.

Input	Level 1/Argument 1	$\{e^{\frac{i\mathrm{ATAN}(7)}{3}}, e^{\frac{i\mathrm{ATAN}(5)}{6}}+1\}$
Output	Level 1/Argument 1	$\{\frac{\sqrt[3]{1+7i}}{\sqrt[3]{\sqrt{1+7^2}}}, \frac{\sqrt[6]{1+5i}}{\sqrt[6]{\sqrt{1+5^2}}}+1\}$

Input	Level 1/Argument 1	$e^{\frac{i\mathrm{ATAN}(7)}{3}}$
Output	Level 1/Argument 1	$\frac{\sqrt[3]{1+7i}}{\sqrt[3]{\sqrt{1+7^2}}}$

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