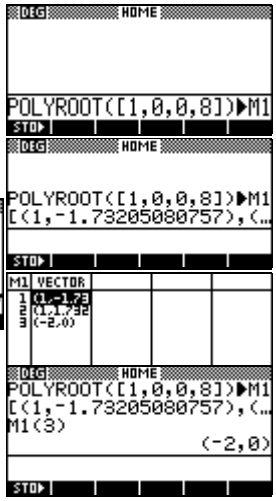
Tips and Tricks: Complex Roots

The **POLYROOT** function can be used to find the roots of complex polynomials, with the results being stored as complex vectors.



For example, suppose we want to find the complex cube roots of –8. Simply re-arrange $z^3 = -8$ into $z^3 + 0z^2 + 0z + 8 = 0$ and then use **POLYROOT** in **HOME**, storing the result into **M1.**

Don't forget that the coefficients in **POLYROOT** must be enclosed in square brackets.

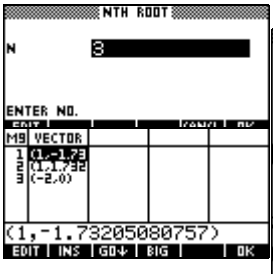
Storing into a matrix allows us not only to view the results more easily, but also to access individual results in **HOME** as shown right.

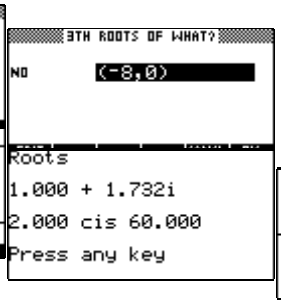
Those who would like a more sophisticated approach might like to try the program shown right. It is available in the G&T and Calculus sections of the Archive CD.

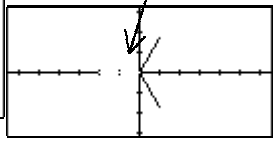
```
ERASE:
INPUT R;"Nth ROOT";"N";"Enter no.";R:
INPUT Z0;R"th roots of what?";"NO";"";Z0:
HFormat▶F: HDigits▶D:
2▶HFormat: 3▶HDigits:
[(1,0)]▶M0:
REDIM M0;(R+1):
-Z0▶M0(R+1):
POLYROOT(M0)▶M9:
EDITMAT M9:
ERASE:
DISP 1;"Roots":
DISP 7;"Press any key":
FOR I=1 TO R STEP 1;
 DISP 3;RE(M9(I))" + "IM(M9(I))"i":
 DISP 5;ABS(M9(I))" cis "ARG(M9(I)):
 FREEZE:
END:
1▶PageNum:
PLOT→ Page:
→DISPLAY Page:
FOR I=1 TO R STEP 1;
 TLINE 0;0;RE(M9(I));IM(M9(I)):
END:
F▶HFormat: D▶HDigits:
FREEZE:
```

It asks which root you want to find of which complex number and then displays the results as a vector in **M9**, in r cis theta form, and as an argand diagram.

Note that it expects that a pair of blank axes have been plotted first for use as a template in the argand diagram. Just go to the **Function** aplet, **unCHK** any functions you don't want to lose and **PLOT**. Then run this program.







Where the root lies on the x axis, the two lines cancel.