1 SUMMARY

To find **all the roots of a cubic polynomial,** i.e. calculate the zeros of

$$a_0 + a_1 x + a_2 x^2 + a_3 x^3 = 0$$

a non-iterative method is used.

ATTRIBUTES — Version: 1.0.0. **Types:** `PA03A; PA03AD.` **Calls:** `FD05`. **Original date:** September 1975 **Origin:** S.Marlow, Harwell.

2 HOW TO USE THE PACKAGE

2.1 Argument list

The single precision version

```
CALL PA03A(A,R,N)
```

The double precision version

```
CALL PA03AD(A,R,N)
```

`A` is a `REAL` (`DOUBLE PRECISION` in the D version) array which must be set by the user to the four coefficients of the polynomial, i.e. set `A(j+1)` = a_j, j=0, 1, 2, 3.

`R` is a `REAL` (`DOUBLE PRECISION` in the D version) array which will be returned containing the roots found by the subroutine. In the case (`N=3`) when there are three real roots they are returned in the order `R(1)` ≤ `R(2)` ≤ `R(3).` In the other case (`N=1`) when there is one real root and two complex roots, the real root is returned in `R(1),` the real part of both complex roots is returned in `R(2)` and the imaginary part is returned in `R(3).` Note that in this case `R(3)` is always positive.

`N` is an `INTEGER` variable which is set by the subroutine to the number of real roots.

3 GENERAL INFORMATION

Workspace: None.

Use of common: None.

Other routines called directly: calls `FD05`.

Input/output: None.

Restrictions: None.

4 METHOD

A non-iterative method is used.