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Submitter :
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Roots of a Cubic Equation

Subroutine subprograms `RRTEQ3` and `DRTEQ3` compute the three roots of

$$x^3 + rx^2 + sx + t = 0 \qquad (*)$$

for real coefficients r, s, t.

On computers other than CDC or Cray, only the double-precision version `DRTEQ3` is available. On CDC and Cray computers, only the single-precision version `RRTEQ3` is available.

Structure:

`SUBROUTINE` subprograms
User Entry Names: `RRTEQ3`, `DRTEQ3`
Obsolete User Entry Names: `RTEQ3` $\equiv$ `RRTEQ3`

Usage:

For `t` = `R` (type `REAL`), `t` = `D` (type `DOUBLE PRECISION`),

```
CALL tRTEQ3(R,S,T,X,D)
```

`R,S,T` (type according to `t`) Coefficients r, s, t in $(*)$.

`X` (type according to `t`) One-dimensional array of length ≥ 3. On exit, `X` is set as described below.

`D` (type according to `t`) On exit, `D` is set to the value of the discriminant of $(*)$:
> 0 : One real root `X(1)` and two complex conjugate roots `X(2)` $+ i$`X(3)`, `X(2)` $- i$`X(3)`;
$= 0$: Three real roots `X(1)`, `X(2)`, `X(3)`, where at least `X(2)` $=$ `X(3)`;
< 0 : Three distinct real roots `X(1)`, `X(2)`, `X(3)`.

Method:

The classical method of Tartaglia-Vieta is used. In certain cases, the solutions are improved by Newton iteration.

Accuracy:

Depends on the coefficients r, s, t. The values of `X(1)`, `X(2)`, `X(3)` and of `D` may be inaccurate if `|D|` is very small, even in the case of “exact” coefficients.

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