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DECUS NO.	FOCAL8-102
TITLE	SOLUTION OF QUADRATIC EQUATIONS WITH COMPLEX COEFFICIENTS
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DATE	April 21, 1970
SOURCE LANGUAGE	FOCAL, 1969



## SOLUTION OF QUADRATIC EQUATIONS WITH COMPLEX COEFFICIENTS

DECUS Program Library Write-up

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### DESCRIPTION

The principle basis of this program is from the discussion of quadratic equation with complex coefficients in INTERMEDIATE MATHEMATICS, PART II (SMSG, Yale University Press, 1961), Section 12-5, pp. 707 - 710. To get around the difficulty of working with the definition of

$$i = \sqrt{-1}$$

since the computer will reject the square root of a negative number, the rectangular form of  $z = a + bi$  is converted to the polar form for the operations upon  $z$  and then back to the rectangular form for the output. The theorem included in the reference mentioned above indicates that some problems will have two solutions, while others will have only one. The example problems shown indicate that this is quite so.

C-FOCAL,1969

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01.01 E
01.05 S PI=3.14159
01.10 A "(A+B*I)X^2+(C+D*I)X+E+G*I=0",! ,?A B C D E G ?,!!
01.20 I (A) 1.3,1.25,1.3
01.25 I (B) 1.3,7.1,1.3
01.30 S DR=C^2-D^2-4*(A*E-B*G)
01.40 S DI=2*C*D-4*(A*G+B*E)
01.50 I (DR) 1.6,1.95
01.60 S TH=FATAN(FABS[DI/DR])
01.70 I (DR) 1.9
01.80 I (DI) 1.81; G 2.1
01.81 S TH=2*PI-TH
01.90 I (DI) 1.93
01.91 S TH=PI-TH; G 2.1
01.93 S TH=PI+TH; G 2.1
01.95 I (DI) 1.97
01.96 S TH=PI/2; G 2.1
01.97 S TH=3*PI/2

02.10 S Z=FSQT(FSQT[DR^2+DI^2])
02.20 S DR=Z*FCOS(TH/2)
02.30 S DI=Z*FSIN(TH/2)
02.40 S R(1)=DR-C; S I(1)=DI-D
02.50 S R(2)=-DR-C; S I(2)=-DI-D
02.60 F N=1,2; D 4
02.70 F N=1,2; T "W",%1,N,"=",%4.03,RF(N),"+",IF(N)," *I",!
02.80 T !!!; G 1.01

04.10 S VF(N)=[2*A*R(N)+2*B*I(N)]/(4*A^2+4*B^2)
04.20 S IF(N)=(+2*A*I(N)-2*B*R(N))/[4*A^2+4*B^2]

07.10 T "THAT'S NO QUADRATIC!!!",!!!
07.20 G 1.01
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\*G0

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 1 \quad B : 0 \quad C : -2 \quad D : -4 \quad E : 0 \quad G : 4$$

$$x^2 - (2 + 4i)x - 4i = 0$$

$$W 1 = 1.000 + 3.732 * I$$

$$W 2 = 1.000 + 0.268 * I$$

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 1 \quad B : 0 \quad C : 1 \quad D : 1 \quad E : 0 \quad G : 1$$

$$x^2 + (1 + i)x + 1 = 0$$

$$W 1 = -1.000 + 0.000 * I$$

$$W 2 = -0.000 + -1.000 * I$$

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 1 \quad B : 0 \quad C : 1 \quad D : -5 \quad E : -12 \quad G : -5$$

$$x^2 + (1 - 5i)x - (12 + 5i) = 0$$

$$W 1 = 2.000 + 3.000 * I$$

$$W 2 = -3.000 + 2.000 * I$$

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 1 \quad B : 0 \quad C : 0 \quad D : -1 \quad E : -1 \quad G : 0$$

$$x^2 - ix - 1 = 0$$

$$W 1 = 0.866 + 0.500 * I$$

$$W 2 = -0.866 + 0.500 * I$$

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 0 \quad B : 1 \quad C : -1 \quad D : 1 \quad E : -1 \quad G : 0$$

$$ix^2 - (1 - i)x - 1 = 0$$

$$W 1 = -0.000 + -1.000 * I$$

$$W 2 = -1.000 + 0.000 * I$$

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 1 \quad B : 0 \quad C : 0 \quad D : -2 \quad E : -1 \quad G : 0$$

$$x^2 - 2ix - 1 = 0$$

$$W 1 = 0.000 + 1.000 * I$$

$$W 2 = 0.000 + 1.000 * I$$

$$(A+B*I)X^2+(C+D*I)X+E+G*I=0$$

$$A : 1 \quad B : 0 \quad C : -2 \quad D : -2 \quad E : 0 \quad G : 2$$

$$x^2 - (2 + 2i)x + 2i = 0$$

$$W 1 = 1.000 + 1.000 * I$$

$$W 2 = 1.000 + 1.000 * I$$

