

Complex Numbers using the Casio fx-115MS

Change to DEGREE mode (press **DRG** → then enter 1 for Degrees).

Note that D should now appear at the top of the screen.

Change to COMPLEX mode (press **MODE** and then 2 for Complex)

Note that CMPLX should now appear at the top of the screen.

Complex numbers are stored as follows:

$100\angle 30$ represents the polar number $100\angle 30$

$30 + 40i$ represents the rectangular number $30 + 40i$ (or $30 + j40$)

Converting between polar and rectangular numbers using the Casio fx-115MS

Converting to **rectangular form**:

The calculator gives complex results in rectangular form by default, so entering a number in polar form and pressing the = key will perform the conversion.

For example:

$100\angle 30 =$ (the value entered in polar form)
86.6 025 (the REAL part is displayed first)
Re ↔ Im (use this key to toggle between REAL and IMAG parts)
50 (the IMAG part is now displayed)
(so the result is $86.6 + 50i$)

Note that even though only the real or imaginary part of the number is displayed, the complete complex number is available for further calculations. For example, to multiply the number above by 10:

$\times 10 =$ (top line on the display will show Ans x 10)
866. 025 (REAL part)
Re ↔ Im (toggle between REAL and IMAG parts)
500 (IMAG part)
(so the result is $866 + 500i$)

Converting to **polar form**:

$30 + 40i \rightarrow R\angle\theta$ (enter the value in rectangular form then press the key
to convert the value to polar form)
50 (the MAGNITUDE is displayed first)
Re ↔ Im (use this key to toggle between MAGNITUDE and ANGLE)
 $\angle 53.13$ (the ANGLE is now displayed)
(so the result is $50\angle 53.13^\circ$)

Note that even though only the magnitude or angle is displayed, the complete complex number is available for further calculations. For example, to multiply the number above by 10:

$\times 10 =$ (top line on the display will show Ans x 10)
300 (REAL part of the answer in rectangular form is displayed)
 $\rightarrow R\angle\theta =$ (convert to polar form. The top line on the display shows Ans $\rightarrow R\angle\theta$)
500 (the MAGNITUDE is displayed first)
Re ↔ Im (toggle between MAGNITUDE and ANGLE)
53.13 (the ANGLE is now displayed)
(so the result is $500\angle 53.13^\circ$)

Calculations using complex numbers using the Casio fx-115MS

Calculations can be performed involving rectangular numbers, polar numbers, and real numbers. Some examples are shown below.

1) Calculate $\frac{300 + 400i}{20 - 50i}$ and express the result in rectangular form:

$(300+400i)/(20-50i)=$	(enter the expression)
-4.8276	(REAL part is displayed first)
$\text{Re} \leftrightarrow \text{Im}$	(toggle between REAL and IMAG parts)
7.9310	(IMAG part)
	(so the result is $-4.8276 + 7.9310i$)

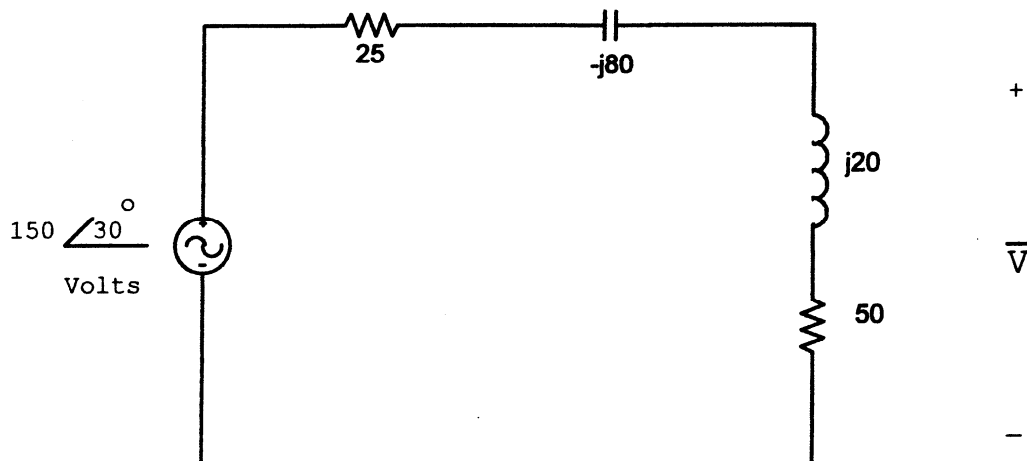
2) Calculate $\frac{100 \angle 30^\circ}{5 + j6}$ and express the result in polar:

$(100 \angle 30)/(5+6i)=$	(enter the expression)
12.01676	(REAL part is displayed first)
$\rightarrow R \angle \theta =$	(convert to polar form. The top line on the display shows Ans $\rightarrow R \angle \theta$)
12.80	(the MAGNITUDE is displayed first)
$\text{Re} \leftrightarrow \text{Im}$	(toggle between MAGNITUDE and ANGLE)
-20.19	(the ANGLE is now displayed)
	(so the result is $12.80 \angle -20.19^\circ$)

Performing calculations using complex numbers with the Casio fx-115MS:

Calculations can be performed using any combination of real and complex numbers. It is generally recommended that the calculator be kept in degree mode for angles for performing AC circuit calculations. Final results are generally most useful in polar form.

Example: Find the phasor voltage V (in polar form) in the circuit below.



Using voltage division,

$$\bar{V} = 150 \angle 30^\circ \left[\frac{50 + j20}{50 + j20 + 25 - j80} \right]$$

Solving this equation using the calculator yields:

$(150 \angle 30) * (50 + 20i) / (50 + 20i + 25 - 80i) =$
 -0.677 (REAL part is displayed first)
 $\rightarrow R \angle \theta =$ (convert to polar form. The top line on the display shows Ans $\rightarrow R \angle \theta$)
 84.1 (the MAGNITUDE is displayed first)
 $\text{Re} \leftrightarrow \text{Im}$ (toggle between MAGNITUDE and ANGLE)
 90.46 (the ANGLE is now displayed)
 (so the result is $84.1 \angle 90.46^\circ$)

Solving simultaneous equations using the Casio fx-115MS

This calculator will not solve simultaneous equations with complex coefficients, but will solve either 2 or 3 simultaneous equations with real coefficients.

Equations are assumed to be one of the following two forms:

For 2 simultaneous equations :

$$a_1x + b_1y = c_1$$

$$a_2x + b_2y = c_2$$

or

For 3 simultaneous equations :

$$a_1x + b_1y + c_1z = d_1$$

$$a_2x + b_2y + c_2z = d_2$$

$$a_3x + b_3y + c_3z = d_3$$

Example:

Solve the following two simultaneous equations:

$$4x - 3y = 34$$

$$2x + 3y = 8$$

Press MODE 3 times until the calculator displays:

EQN

1

(Enter 1 to select the options of solving simultaneous equations)

The calculator now displays:

Unknowns?

2 3

(Enter 2 to select 2 simultaneous equations)

The calculator now displays:

a1? (Enter 4 =)

The calculator now displays:

b1? (Enter -3 =)

The calculator now displays:

c1? (Enter 34 =)

The calculator now displays:

a2? (Enter 2 =)

The calculator now displays:

b2? (Enter 3 =)

The calculator now displays:

c2? (Enter 8 =)

The calculator now displays:

a1? (Enter 4 =)

The calculator now displays:

b1? (Enter -3 =)

The calculator now displays:

x = 7 (this is the first answer)

(Enter = for the next answer)

y = -2 (this is the second answer)

Press the MODE key to exit the simultaneous equation solver.