Chapter 10 / **Example 19**

# Finding roots of a complex number

Use your calculator to find all the solutions of the equation $z^5 = 2 + 5\mathrm{i}$ in Cartesian form.

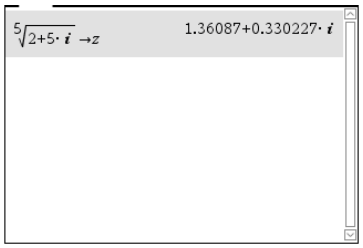
Open a new document and add a Calculator page.

Find the fifth root of $2 + 5\mathrm{i}$ and store it as z.

Type $\sqrt[5]{2+5\mathrm{i}}$, then press ctrl var (sto→) z and press enter.

To enter i press (π▸) and select ***i*** from the menu.

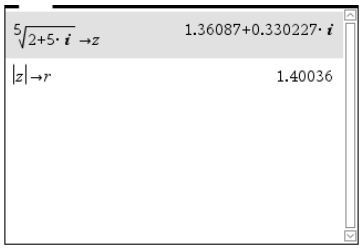
The calculator gives just one solution of the multiple valued root.




Where $z = r\,\mathrm{cis}\,\theta$, $\sqrt[n]{z} = \sqrt[n]{r}\,\mathrm{cis}\dfrac{\theta + 2k\pi}{n}, k = 0, 1, 2, \ldots n-1$.

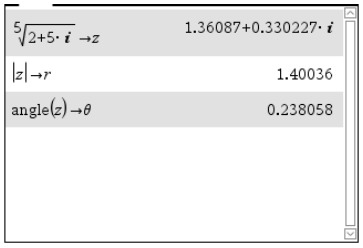
Find $r$ and store it by typing $|z|$, press ctrl var (sto→) r and press enter..

Enter the modulus function by pressing (|▫|) and selecting |▫| with the trackpad.




Find $\theta$ and store it by typing menu 2:Number | 9:Complex Number Tools | 4:Polar Angle, type z, close the parentheses, press ctrl var (sto→) $\theta$ and press enter.

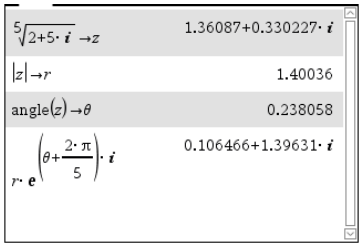
To enter $\theta$ press (π▸) and select $\theta$ from the menu.




Now use the formula for arguments to find all the solutions and convert these to Cartesian form.

Type $r \times e^{\left(\theta + \frac{2\pi}{5}\right)\mathrm{i}}$ and press enter.

Since the default format of complex numbers is Cartesian, the GDC converts from polar to Cartesian format without needing to enter any additional command.



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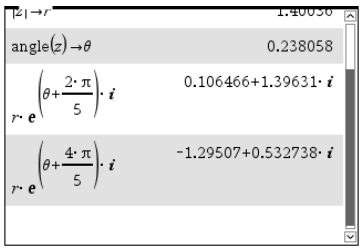
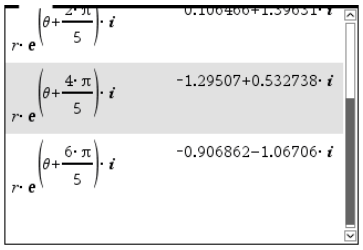
# Finding roots of a complex number

To repeat this calculation, select it and press enter.

Edit the expression, changing 2 to 4 and press enter.




Repeat changing 4 to 6 and press enter.




Repeat changing 6 to 8 and press enter.

$z_1 = 1.36 + 0.330\text{i}$, $z_2 = 0.106 + 1.40\text{i}$, $z_3 = -1.30 + 0.533\text{i}$,
$z_4 = -0.907 - 1.07\text{i}$, $z_5 = 0.735 - 1.19\text{i}$.