 Arithmetic in polar and exponential form

Multiplication of complex numbers

1. Consider two complex numbers and .

Show that

1. Choose integers or surds a, b, c and d and write two complex numbers in Cartesian form, and
   1. Multiplying in Cartesian form:
2. Calculate in Cartesian form.
3. Convert into polar form.
   1. Multiplying in polar form:
4. Convert and each into polar form.
5. Use the polar form of and to calculate in polar form.
   1. Multiplying in exponential form:
6. Convert and each into exponential form
7. Use the exponential form of and to calculate in exponential form.
8. Convert the exponential form of into polar form.
9. Geometric interpretation.
   1. You have two complex numbers, and on an Argand plane.

Using only a ruler and protractor or their equivalence within graphing software, explain how you can use the result from question 1 to locate and determine the complex number

* 1. Confirming your explanation:

1. Plot two complex numbers, and , on a Cartesian plane.
2. Use your method from part a) to plot the complex number .
3. Convert and into polar form.
4. Use the polar form of and to calculate in polar form.
5. Plot from the polar form to confirm your result.

Division of complex numbers

1. Consider two complex numbers and .

Show that

1. Choose integers or surds a, b, c and d and write two complex numbers in Cartesian form, and
   1. Dividing in Cartesian form:
2. Calculate in Cartesian form.
3. Convert into polar form.
   1. Dividing in polar form:
4. Convert and each into polar form.
5. Use the polar form of and to calculate in polar form.
   1. Dividing in exponential form:
6. Convert and each into exponential form
7. Use the exponential form of and to calculate in exponential form.
8. Convert the exponential form of into polar form.
9. Geometric interpretation.
   1. You have two complex numbers, and , on an Argand plane.

Using only a ruler and protractor or their equivalence within graphing software, explain how you can use the result from question 1 to locate and determine the complex number .

* 1. Confirming your explanation:

1. Plot two complex numbers, and , on a Cartesian plane.
2. Use your method from part a) to plot the complex number .
3. Convert and into polar form.
4. Use the polar form of and to calculate in polar form.
5. Plot from the polar form to confirm your result.

Powers of complex numbers

1. Consider the complex number
   1. Using Cartesian form, calculate :
   2. Using polar form, calculate :
   3. Using exponential form, calculate :
2. Choose integers or surds a and b, given the complex number , express the complex number in Cartesian, polar and exponential form.
   1. Using Cartesian form, calculate :
   2. Using polar form, calculate:
   3. Using exponential form, calculate :
3. Geometric interpretation.
   1. You have a complex number, , on an Argand plane.
   2. Using only a ruler and protractor or their equivalence within graphing software, explain how you can use the result from question 1b to locate and determine the complex number where is an integer.
   3. Confirming your explanation:
4. Plot a complex number, , on a Cartesian plane.
5. Use your method from part a) to plot the complex number .
6. Convert into polar form.
7. Use the polar form of to calculate in polar form.
8. Plot from the polar form to confirm your result.