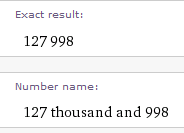
**Complex Numbers and WolframAlpha**



WolframAlpha will perform the basic arithmetic operations

with complex numbers as easily as it performs operations

with real numbers.

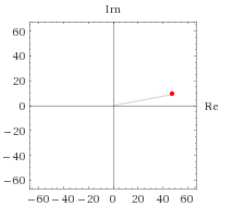


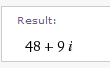
If we multiply two real numbers, (234)(547),

WolframAlpha will return the answer of 127,998.

If we multiply two complex numbers (2 + 7*i*)(3 – 6*i*), we expect to see the same kind of results in WolframAlpha.

However, we see the answer and a graph!





Complex numbers *can* be graphed, but not on a single number line. Complex numbers are graphed on a two-dimensional coordinate plane called the *complex plane*.

A complex number can be represented as a point (*a, b*). The horizontal axis is called the *real axis* (labeled Re above) and the vertical axis is referred to as the *imaginary axis* (labeled Im above).

Example 1. Plot on the complex plane.

3 – *i* corresponds to the point (3, –1).

1 + 4*i* corresponds to the point (1, 4).

Use WolframAlpha to perform the indicated operations and provide a sketch of the approximate location of the solution in the complex plane.

1.  = \_\_\_\_\_\_\_\_\_\_ 2.  = \_\_\_\_\_\_\_\_\_\_\_\_\_



3.  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 4.  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

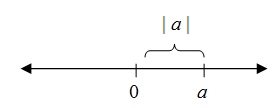




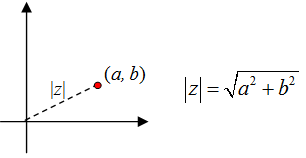


5. Plot on the complex plane: –4 and 2*i* *Hint:* rewrite each number in *a* + *bi* form



Remember that the absolute value | *a* | of a real number *a* may be

thought of as its distance from zero on a number line.

Similarly, we may define the absolute value | *z* | of a complex number as its distance from the origin in the complex plane to the

point (*a, b*).



The absolute value of a complex number is also called its *modulus*.

To find the absolute value of a complex number using WolframAlpha, we may input either *abs* ( ) or *modulus*( ).



Example 2. Evaluate 

Note that the answer is a real

number.

Use WolframAlpha to evaluate the absolute value. Give the exact answer and a decimal approximation to 12 decimal places where appropriate.

6.  Exact: \_\_\_\_\_\_\_\_\_\_\_ Approximate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7.  Exact: \_\_\_\_\_\_\_\_\_\_\_ Approximate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8.  Exact: \_\_\_\_\_\_\_\_\_\_\_ Approximate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9.  Exact: \_\_\_\_\_\_\_\_\_\_\_ Approximate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If we can plot points on the complex plane, can we also have graphs on the complex plane?

Absolutely!

One of the most beautiful graphs in the complex plane is the Mandelbrot Set. If you input *Mandelbrot Set* in WolframAlpha you will see a black and white graph on the complex plane. An internet search with the same input will guide you to many websites with beautiful full color versions of the same set.