

## Lesson 9: The Geometric Effect of Some Complex Arithmetic

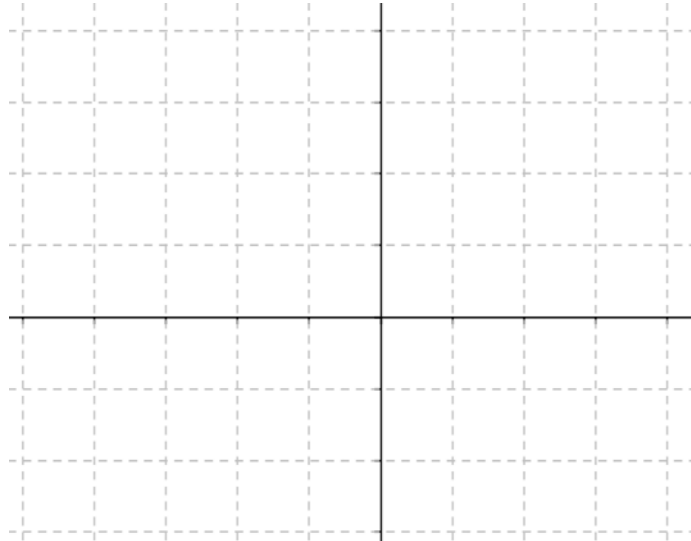
### Classwork

#### Exercises

1. Taking the conjugate of a complex number corresponds to reflecting a complex number about the real axis. What operation on a complex number induces a reflection across the imaginary axis?

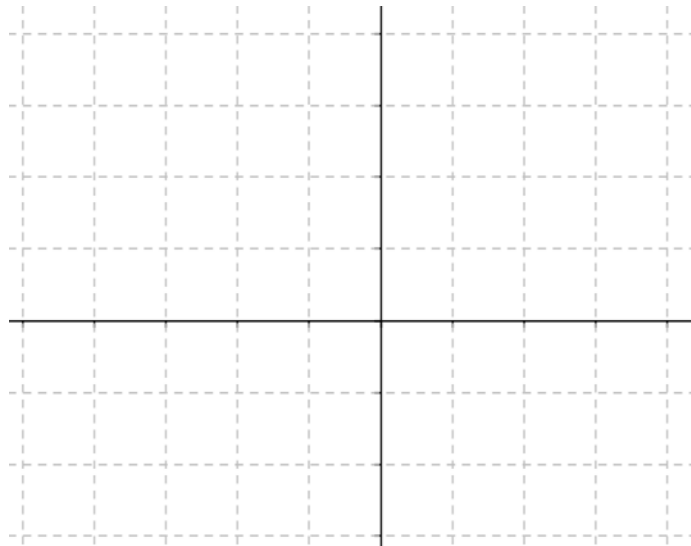
2. Given the complex numbers  $w = -4 + 3i$  and  $z = 2 - 5i$ , graph each of the following:

- a.  $w$
- b.  $z$
- c.  $w + 2$
- d.  $z + 2$
- e.  $w - 1$
- f.  $z - 1$



3. Describe in your own words the geometric effect adding or subtracting a real number has on a complex number.

4. Given the complex numbers  $w = -4 + 3i$  and  $z = 2 - 5i$ , graph each of the following:
- $w$
  - $z$
  - $w + i$
  - $z + i$
  - $w - 2i$
  - $z - 2i$



5. Describe in your own words the geometric effect adding or subtracting an imaginary number has on a complex number.

**Example 1**

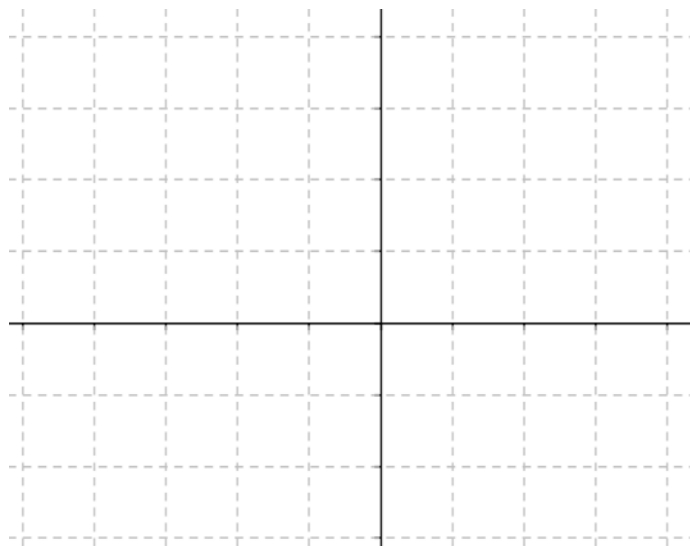
Given the complex number  $z$ , find a complex number  $w$  such that  $z + w$  is shifted  $\sqrt{2}$  units in a southwest direction.

**Lesson Summary**

- The conjugate,  $\bar{z}$ , of a complex number  $z$ , reflects the point across the real axis.
- The negative conjugate,  $-\bar{z}$ , of a complex number  $z$ , reflects the point across the imaginary axis.
- Adding or subtracting a real number to a complex number shifts the point left or right on the real (horizontal) axis.
- Adding or subtracting an imaginary number to a complex number shifts the point up or down on the imaginary (vertical) axis.

**Problem Set**

1. Given the complex numbers  $w = 2 - 3i$  and  $z = -3 + 2i$ , graph each of the following:
  - a.  $w - 2$
  - b.  $z + 2$
  - c.  $w + 2i$
  - d.  $z - 3i$
  - e.  $w + z$
  - f.  $z - w$



2. Let  $z = 5 - 2i$ , find  $w$  for each case.
  - a.  $z$  is a  $90^\circ$  counterclockwise rotation about the origin of  $w$ .
  - b.  $z$  is reflected about the imaginary axis from  $w$ .
  - c.  $z$  is reflected about the real axis from  $w$ .
3. Let  $z = -1 + 2i$ ,  $w = 4 - i$ , simplify the following expressions.
  - a.  $z + \bar{w}$
  - b.  $|w - \bar{z}|$
  - c.  $2z - 3w$
  - d.  $\frac{z}{w}$

4. Given the complex number  $z$ , find a complex number  $w$  where  $z + w$  is shifted
- $2\sqrt{2}$  units in a northeast direction.
  - $5\sqrt{2}$  units in a southeast direction.