# Complex Conjugates

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Instructions: Open up the Complex Number graphing applet. You can either find the link on my website under "Complex Number Graphing Applet"or enter:http://tube.geogebra.org/student/m282331

1. You will see that two points are already plotted for. They have complex coordinates displayed by the point. We will be investigating the multiplication of complex numbers.

2. We are going to start out simple. Check the orange box for multiplication.

   Move point A to $(1, 0i)$. You will notice that anywhere you move point B then point E moves there also. This makes sense because the coordinates of point E are the coordinates of point A times the coordinates of point B. Since the coordinates of point A are $(1, 0i)$ then you multiplying by 1 and you would still get the same thing.

   Move point A to $(0, 1i)$. Move point B around and see where point E is in relation to point B. This is multiplying by $(0, 1i)$ or $1i$. Write down a couple coordinate values for B in the first quadrant and corresponding coordinate values for E.

   *Coordinates of point B: (  ,  ) point E: (  ,  )*  *Coordinates of point B: (  ,  ) point E: (  ,  )*
   *Coordinates of point B: (  ,  ) point E: (  ,  )*  *Coordinates of point B: (  ,  ) point E: (  ,  )*

   Create a conjecture that will tell you what happens when you multiply a number by $i$. We will then discuss some conjectures as a class later.

   You switch the imaginary and real components. The real component becomes negative. This rotates the point counterclockwise by 90 degrees.

3. With respect to complex numbers, we have this concept **conjugate numbers**. The **conjugate** of a complex number has the same real component but negative imaginary component. In mathematical terms point A has coordinates $(a, bi)$ and it's conjugate, point B has coordinates $(a, -bi)$

   Drag point A to somewhere in the first quadrant. Then in the input box for point B in the third quadrant input the conjugate of point A. *Coordinates of point A: (  ,  ) point B: (  ,  ) point E: (  ,  )*

   Drag point A to somewhere in the second quadrant and again input the conjugate of point A in the input box for point B. *Coordinates of point A: (  ,  ) point B: (  ,  ) point E: (  ,  )*

   Drag point A to somewhere in the third quadrant and again input the conjugate of point A in the input box for point B. *Coordinates of point A: (  ,  ) point B: (  ,  ) point E: (  ,  )*

   Drag point A to somewhere in the fourth quadrant and again input the conjugate of point A in the input box for point B. *Coordinates of point A: (  ,  ) point B: (  ,  ) point E: (  ,  )*

   What similarity do you notice with all of the coordinates for point E? What conjecture can we make if we multiply a complex number and it's conjugate? We will later discuss some conjectures as a class later.

   All of the imaginary components of point E are 0. Multiplying a complex number by it's conjugate will get rid of the imaginary component.