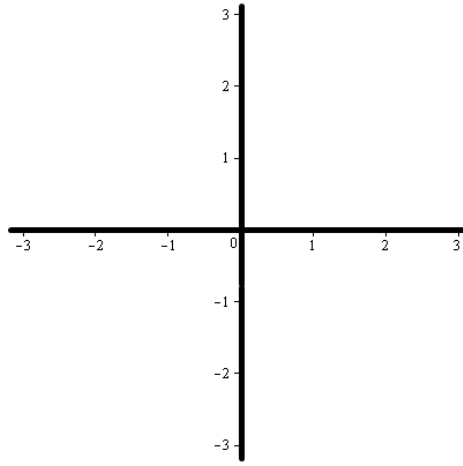


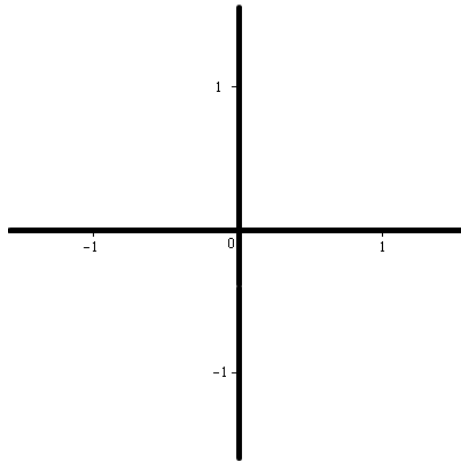
# Complex Analysis

## Visualization

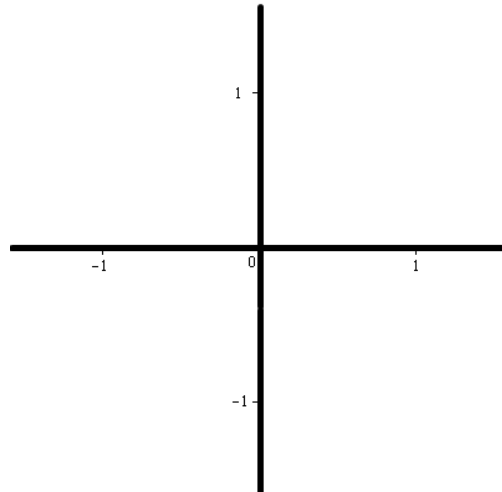
1. Consider  $z = 2 + i$  and  $w = -1 + 2i$ . Draw the vectors  $z, w, z + w$ , and  $z - w$



2. Consider  $z = 1 + i$  and  $w = -1 + i$ . Draw the vectors  $z, w, z \cdot w, \frac{z}{w}, \frac{1}{z}$ , and  $\bar{z}$



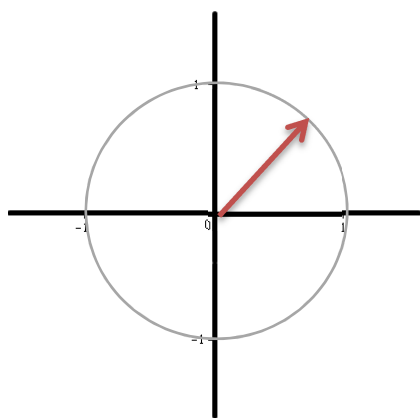
3. Draw the following vectors:  $z_1 = e^{\frac{i\pi}{2}}$ ,  $z_2 = 0.5e^{i\pi}$ ,  $z_3 = \sqrt{2}e^{\frac{-i\pi}{4}}$ , and  $z_4 = e^{\frac{i5\pi}{4}}$



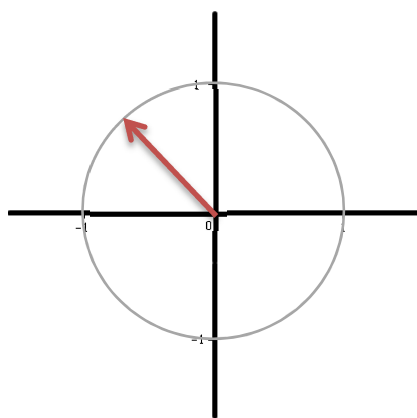
4. Describe in simple geometric terms what happens to a vector  $z$  when:

- a. it is multiplied by 2
- b. it is multiplied by  $-1$
- c. it is multiplied by  $i$
- d. it is squared

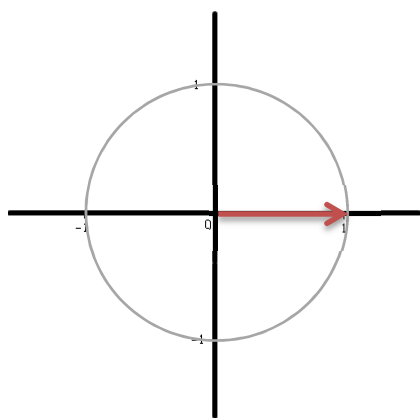
5. Consider the vector shown and draw the new vector(s) as indicated (the gray circle represents the unit circle)



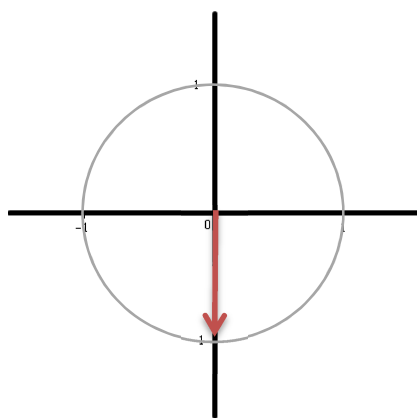
Find all four 4<sup>th</sup> roots (approx.)



Find  $z^4$



Find all third roots of unity



Find one sixth root