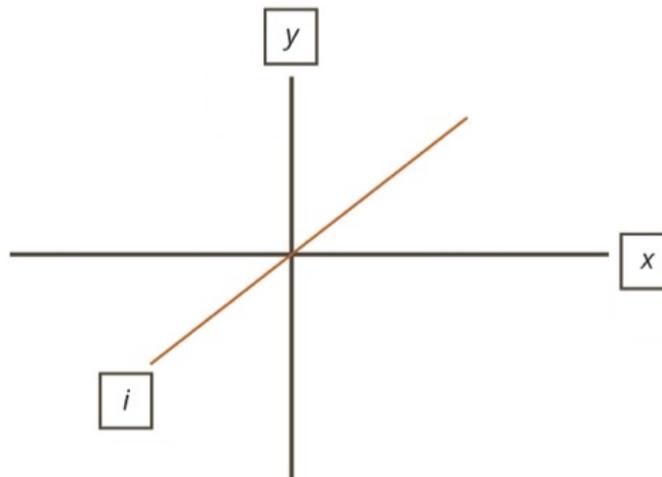


HW 2.2.1: Complex Roots Visualization

1. Consider the graph of $f(x) = x^2 - 4x + 5$
 - a. Graph $f(x)$ in detail in the xy plane of the coordinate system provided on the next page without using a graphing calculator.
 - b. What conclusion can you make about the roots of $f(x)$?
 - c. Show that $2 - i$ is a root for $f(x)$.
 - d. Show that $f(2 - 3i)$ is a real number.
 - e. Show that $f(3 + i)$ is not a real number.
 - f. Try a few more complex values and make a conjecture about values of a and b for which $f(a + bi)$ is a real number. Explain how you arrived at your conjecture and prove that it is true.
 - g. Lastly, draw a graphical representation of what your above answer imply about the real-valued outputs of f with regard to the inclusion of a complex domain.



2. Consider the graph of $f(x) = x^2 + 8x + 18$
- Graph $f(x)$ in detail in the xy plane of the coordinate system provided on the next page without using a graphing calculator.
 - What conclusion can you make about the roots of $f(x)$?
 - Show that $-4 + \sqrt{2}i$ is a root for $f(x)$.
 - Show that $f(-4 - 3i)$ is a real number.
 - Show that $f(3 + 2i)$ is not a real number.
 - Try a few more complex values and make a conjecture about values of a and b for which $f(a + bi)$ is a real number. Explain how you arrived at your conjecture and prove that it is true.
 - Lastly, draw a graphical representation of what your above answer imply about the real-valued outputs of f with regard to the inclusion of a complex domain.

