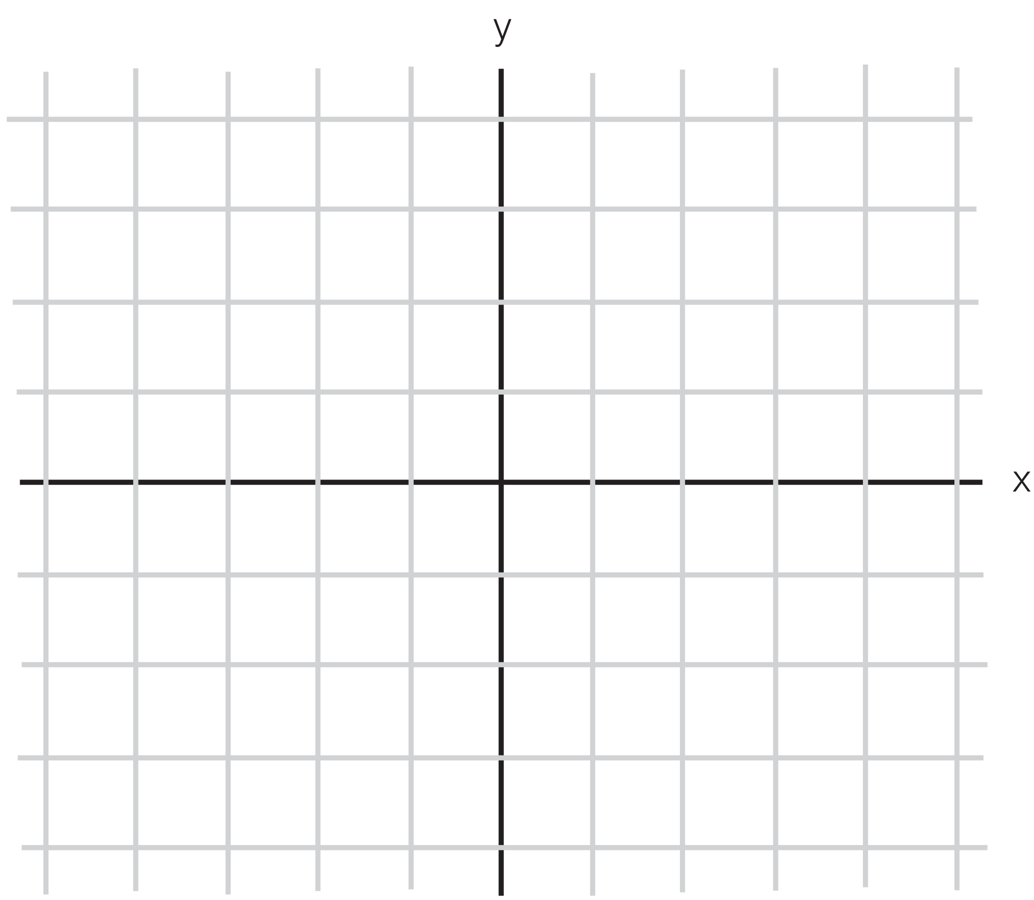
We have learned about the coordinate plane, and that we can define points as pairs in that plane. A point a x-value of x, and y-value of y, would be...

$$v = (x, y)$$

These point pairs are also called vectors. Vectors are useful, and you can add them and do all sorts of other useful operations with them.

$$v_1 = (x_1, y_1)$$
$$v_2 = (x_2, y_2)$$
$$v_1 + v_2 = (x_1 + x_2, y_1 + y_2)$$



Pick two vectors in x and y, add them together, and show the result.

But there's another way to think about a number in two dimensions.

Consider the number *i* that we've learned about...

$$i = \sqrt{-1}$$

We can also think about a number that has *i* in it as a 2-d number

$$c = x + iy$$

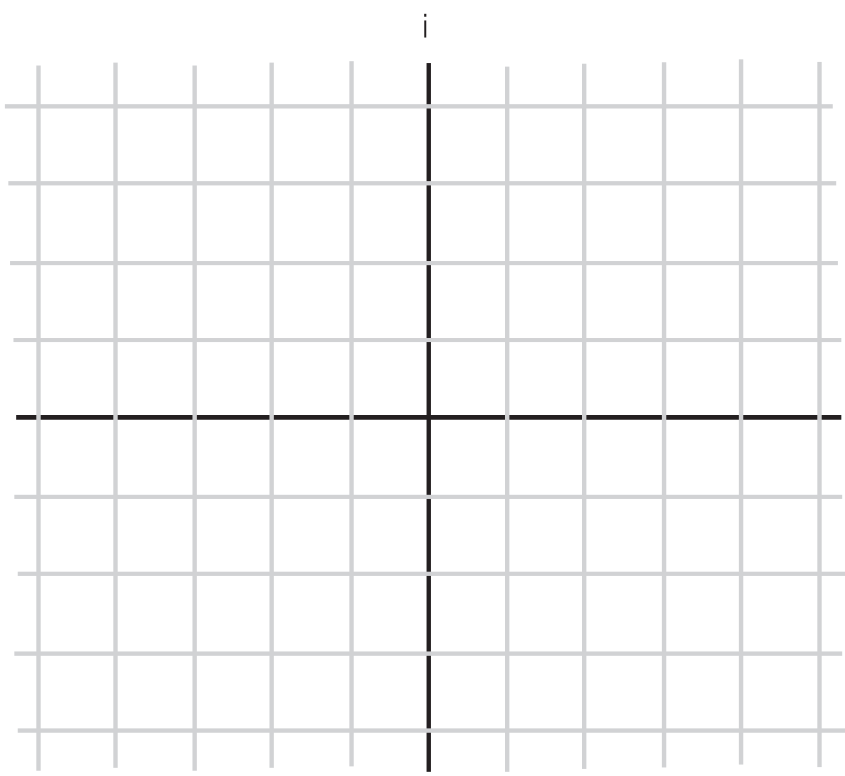
You can add these too!

$$c_1 = x_1 + iy_1$$
$$c_2 = x_2 + i_{y2}$$
$$c_1 + c_2 = x_1 + x_2 + iy_1 + iy_2$$

Can you simplify the final sum into an equation with only 1 instance if *i*?

$$c_1 + c_2 = (x_1 + x_2) + i($$

Look, no more ordered pairs!
Now, Draw two complex numbers and their sum, below...

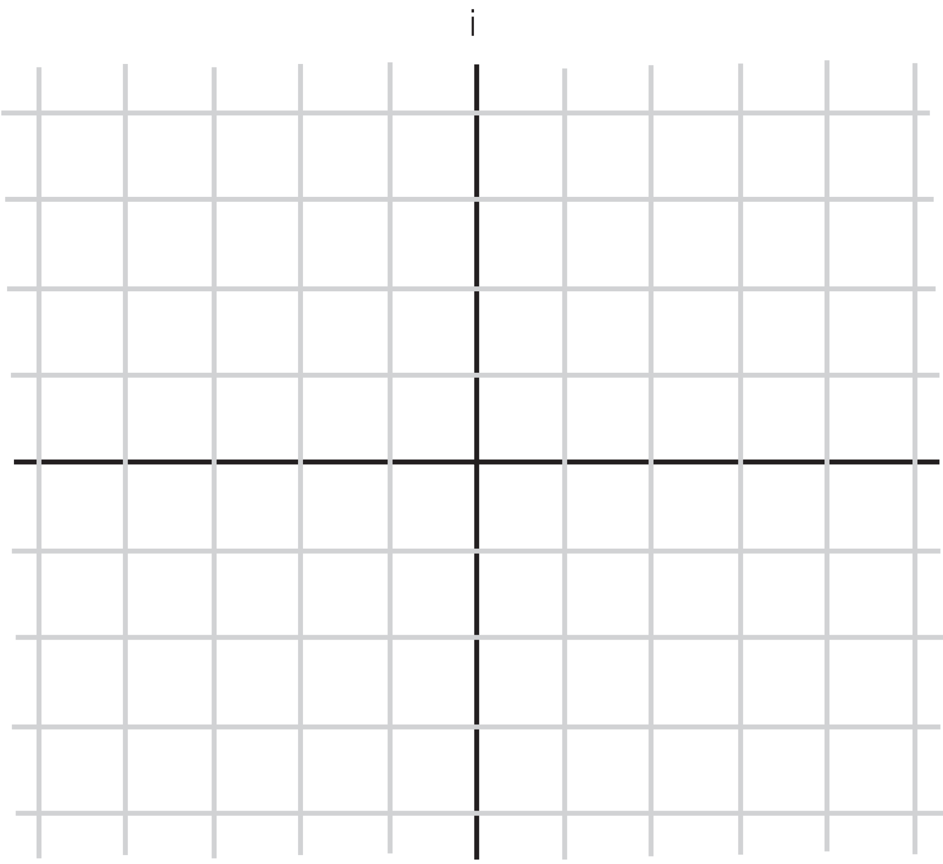


It's also possible to multiply complex numbers, just by knowing the definition of $i = \sqrt{-1}$ and the normal rules of elementary algebra

Please simplify the product so that one instance of *i* shows up

$$
\begin{aligned}
&c_1 = x_1 + iy_1 \\
&c_2 = x_2 + iy_2 \\
&c_1 * c_2 = (x_1 + iy_1) * (x_2 + iy_2) \\
&= x_1 * (x_2 + iy_2) + iy_1 * (x_2 + iy_2) \\
&=
\end{aligned}
$$

Now, pick some complex numbers and draw their product



What do you notice about multiplying two complex numbers together when you plot the result?

Let’s say you have a complex number of the form...

$$c_1 = x_1 + iy_1$$

How “long” is the line that goes from the origin (the middle of the coordinate axes) to the point c1?

If you could pick two complex numbers where the length of c1 and c2 was both 1, what would be the effect of multiplying them?

Now, pick some complex numbers of this kind and draw their product