

Mathematics, Bonus Question, Complex Numbers

December 3, 2012

As you've all now been introduced to complex numbers, you are now equipped to see so much more from the numbers that you know so well. Much like Alice in *Through The Looking Glass* (written by Lewis Carroll, himself a mathematician) we're now able to explore so much more a world so familiar and yet out of reach.

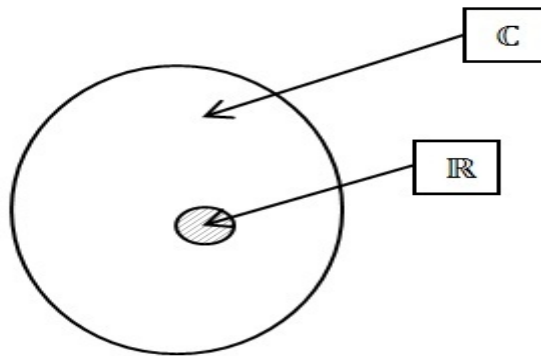


Figure 1: The set of Real numbers \mathbb{R} is just a subset of the set of complex numbers \mathbb{C}

Sometimes in engineering and physics we find ourselves working with complex numbers, we needn't fret as we'll see they're really rather convenient. A truly amazing result is Euler's formula which states that:

$$e^{jx} = \cos(x) + j\sin(x) \quad (1)$$

Now before we begin, we must remember that we are to work in radians, *Not* degrees!

Can you please:

1. By considering e^{jx} and e^{-jx} derive the exponential equations for $\sin(x)$ and $\cos(x)$
hint: substitute each into Euler's formula, then solve the simultaneous equations
2. By considering $e^{j\pi}$ can you please derive Euler's identity: $e^{j\pi} + 1 = 0$
3. Write the exponential form of $\cos(jx)$ and $-j\sin(jx)$, do you recognise the results?
hint: think hyperbolic