7-13. Let's find roots of some non-real non-imaginary complex numbers!

(a) Find all the square roots of the complex number given by the point on the unit circle with an angle of 30°.

(b) Find all the square roots of $\cos(\pi/4) + i\sin(\pi/4)$.

(c) Find all the square roots of $\frac{1}{2} + \frac{\sqrt{3}}{2}i$.

(d) How are these square roots different from the square roots of 1?

(e) Now find the cube roots of all three of those points.

(f) Find the quartic roots of those three points.

(g) In general, how do we find the nth roots of some point on the unit circle?

7-14. Finally, find *every root* of *every complex number*! *One formula for everyyyyyyyything.*

$$\sqrt[n]{z} = \underbrace{|z|^{1/n}}_{\text{real part of complex number "z" raised to the 1/n power to obtain radius}} \underbrace{\left(\cos\frac{\theta+2\pi k}{n} + i\sin\frac{\theta+2\pi k}{n}\right)}$$

Each root of complex number z will be evenly spaced on the graph, $\left(\frac{2\pi}{n}\right)$. However, in order for the formula to be able to differenti- ate between complex numbers, we must add the argument of z $\left(\frac{\theta+2\pi}{n}\right)$. Now, in order to get n roots (which must occur according to the fundamental theorem of algebra) we must include variable k to ensure that giving: $\frac{\theta+2\pi k}{n}$ $\{k=0,1,2\ldots n-1\}$

When its put all together:

$$|z|^{1/n}\left(\cos\frac{\theta+2\pi k}{n} + i\sin\frac{\theta+2\pi k}{2}\right)$$