Dear students,

I was asked: how can we simplify expression using Euler's Identity?
Recall that Euler's Identity says that

$$e^{i\theta} = cos(\theta) + isin(\theta).$$

There are two main ways that we want to use this. We learn from the identity that

$$e^{i\theta} + e^{-i\theta} = 2cos(\theta),$$

because *cos* is an *even* function, while *sin* is *odd*. We also learn that

$$e^{i\theta} - e^{-i\theta} = 2isin(\theta),$$

for the same reason.

Example:

In class, I mentioned that we wanted to simplify

$$\frac{1}{4i}2(e^{(3+2i)t} - e^{(3-2i)t}).$$

This looks complicated, but it's actually totally real.
We simplify using the identities above as follows:

$$\begin{aligned}\frac{1}{4i}2(e^{(3+2i)t} - e^{(3-2i)t}) &= \frac{e^{3t}}{2i}(e^{2it} - e^{-2it}) \\ &= \frac{e^{3t}}{2i}(2isin(2t)) = e^{3t}sin(2t)\end{aligned}$$