What are those Negative Frequencies?!

Recall: every real sinusoid can be thought of as being made from two complex sinusoids:

- one w/ positive freq.
- one w/ negative freq.

\[ A \cos(w_0 t + \phi) = \frac{A}{2} e^{i (w_0 t + \phi)} + \frac{A}{2} e^{-i (w_0 t - \phi)} \]

\[ \uparrow w_0 > 0 \]

comp. sinusoid w/ pos. freq.
comp. sinusoid w/ neg. freq.

These positive & negative freq. components show up in the:
1. Complex FS coefficients
2. Fourier Transform

Illustrate for FT

The dots above represent:

\[ \frac{3}{2} e^{i (5t - \pi/2)} + \frac{3}{2} e^{i (5t + \pi/2)} \]

which combine to make:

\[ 3 \cos(5t - \pi/2) \]

This is the physical sinusoidal component related to these mathematical components.