



ChatGPT 4o



- $C'(\omega_1) = A'(\omega_1) \cdot B'(\omega_1) = (2 + i) \cdot (1 + i) = 1 + 3i$
- $C'(\omega_2) = A'(\omega_2) \cdot B'(\omega_2) = 1 \cdot 0 = 0$
- $C'(\omega_3) = A'(\omega_3) \cdot B'(\omega_3) = (2 - i) \cdot (1 - i) = 1 - 3i$

Thus, $C' = [6, 1 + 3i, 0, 1 - 3i]$.

6. **Inverse FFT (IFFT) to Interpolate Back:** Apply the inverse FFT to transform C' back to the time domain, dividing by the length (4) to obtain the final coefficients.

After interpolation, we find:

$$C(x) = 2 + 3x + x^2$$

Thus, the coefficient of x^2 , or $C(2)$, is indeed 1.



show me how you now calculate the inverse FFT in detail



Let's go through the **Inverse FFT (IFFT)** calculation in detail, starting from the pointwise multiplication results. The goal of the inverse FFT is to take the frequency-domain representation we obtained (after pointwise multiplication) and return it to the time-domain, or coefficient form, of the polynomial $C(x)$.

Setup for Inverse FFT

After the pointwise multiplication, we have:

$$C' = [6, 1 + 3i, 0, 1 - 3i]$$

Since we zero-padded to length 4, we're working with a vector length $n = 4$, and we'll use the 4th roots of unity in the inverse direction to perform the inverse FFT.

The inverse FFT formula for a sequence $\downarrow = [C'(0), C'(1), C'(2), C'(3)]$ is:

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