Complex numbers

Q1) Evaluate $z = (2 - i)^2 + \frac{7-4i}{2+i} - \frac{1}{1+i}$, and give the result in rectangular and complex exponential form.

Q2) Given $y = -2x^2 + 3x - c$, where c is a real number, answer the following questions:

    a) Find c for the case when there is only 1 repeated root.
    b) For $c = -2$, fine the roots of the equation
    c) When $c \rightarrow +\infty$, there will only be (repeated/complex/real)? Roots
    d) When $c \rightarrow -\infty$, there will only be (repeated/complex/real)? Roots

Q3) Evaluate z^4 given $z = \overline{(1 + 2i)}$

Q4) Find the values of a, b for $(a - bi)^2(3 + 5i) = \overline{(-6 - 24i)}$.

DFT

Q5)

    a) Given $x = [2,0,0,3]^T$, find DFT coefficients X with $N = 4$.

    b) Given $X = N \begin{bmatrix} 0 \\ 3e^{-j\frac{\pi}{4}} \\ 0 \\ 0 \end{bmatrix}$, find x via IDFT with $N = 4$, and suggest the equation describing $x[n]$ by inspection.

    c) Given $X = N \begin{bmatrix} 2 \\ 3e^{-j\frac{\pi}{4}} \\ 0 \\ 0 \end{bmatrix}$, find solution of x found in Q5b, suggest the equation describing $x[n]$ by inspection.

// To be Discussed in the lecture

Q6) The following questions to help students have intuition of DFT.

For $N = 16$,

    a) Describe the DFT Analysis matrix W.
    b) Provide the equation representing the kth row of W and hence list the first 4 terms.
    c) How is the kth row of W related to the DFT coefficient $X(k)$. Provide an interpretation.
    d) Given $x(n) = 3e^{j(\frac{2\pi}{16}n+\frac{\pi}{3})}$, what is $X(k)$?
    e) Given $x(n) = 3\sin(\frac{2\pi}{16}n + \frac{\pi}{3})$, what is $X(k)$? How is this answer differ to Q6d.

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