EE 221: Signal Analysis & Systems
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Complex Numbers: Practice Problems

Q1. For $\mathbf{A} = -5 + j4$ and $\mathbf{B} = 6 - j7$, find $\mathbf{A} - \mathbf{B}$?

Q1. Answer. $-11 + j11$

Q2. For $\mathbf{A} = -5 + j4$, $\mathbf{B} = 6 - j7$ and $\mathbf{C} = -5 - j9$, find $3\mathbf{A} - 2\mathbf{B} + 6\mathbf{C}$?

Q2. Answer. $-57 - j28$

Q3. For $\mathbf{A} = -5 + j4$, $\mathbf{B} = 6 - j7$ and $\mathbf{C} = -5 - j9$, find $j^7\mathbf{A}^2(\mathbf{B} + \mathbf{C})$?

Q3. Answer. $-184 + j631$

Q4. For $\mathbf{B} = 6 - j7$ and $\mathbf{C} = -5 - j9$, find $[(\mathbf{B} + \mathbf{B}^*)(\mathbf{C} - \mathbf{C}^*)^*]^*$?

Q4. Answer. $0 - j216$

Q5. For $\mathbf{B} = 6 - j7$ and $\mathbf{C} = -5 - j9$, find $\mathbf{B}\,\mathrm{Re}\{\mathbf{C}\} + \mathbf{C}\,\mathrm{Im}\{\mathbf{B}\}$?

Q5. Answer. $5 + j98$

Q6. For $\mathbf{A} = -5 + j4$ and $\mathbf{B} = 6 - j7$, find $(\mathbf{A} - \mathbf{B})/(2\mathbf{BA})$?

Q6. Answer. $0.09627 + j0.08996$

Q7. For $\mathbf{A} = -5 + j4$ and $\mathbf{B} = 6 - j7$, find $(1/\mathbf{A}^*) - 1/\mathbf{B}$?

Q7. Answer. $-0.1925 + j0.0152$

Q8. Use Euler's identity to find $\mathbf{A} = e^{-j2}$ in rectangular form ?

Q8. Answer. $-0.4161 - j0.9093$

Q9. Use Euler's identity to find $\mathbf{A} = e^{3+j2}$ in rectangular form ?

Q9. Answer. $-8.3585 + j18.2637$

Q10. Use Euler's identity to find $\mathbf{A} = \sin(j2)$ in rectangular form ?

Q10. Answer. $0 + j3.6269$

Q11. Use Euler's identity to find $\mathbf{A} = \cos(-j)$ in rectangular form ?

Q11. Answer. $1.5431 + j0$

Q12. Convert $\mathbf{A} = -14.6 + j28.4$ into exponential form (use principal value for the angle and use radians) ?

Q12. Answer. $31.9331\ e^{j2.0456}$

Q13. Convert $\mathbf{A} = -11.2 - j21.1$ into exponential form (use principal value for the angle and use degrees) ?

Q13. Answer. $23.8883\ e^{-j117.9596°}$

Q14. Convert $\mathbf{A} = 15.4 - j18.7$ into polar form (use principal value for the angle and use radians) ?

Q14. Answer. $24.2250\ \angle -0.8819$

Q15. Convert $\mathbf{A} = 12.5\angle 7.4839$ into rectangular form (notice that $7.4839 > 2\pi$) ?

Q15. Answer. $4.5295 + j11.6505$

Q16. Convert $\mathbf{A} = 42.3\angle -112.5°$ into rectangular form ?

Q16. Answer. $-16.1875 - j39.0801$

Q17. Convert $\mathbf{A} = -18.7\, e^{-j120°}$ into rectangular form (the negative before 18.7 can be thought of as the negative of the whole number)?

Q17. Answer. $9.3500 + j16.1947$

Q18. Determine $\mathbf{B} = j^j$. Hint: write j in the polar form?

Q18. Answer. $0.20788 + j0$

Q19. For $\mathbf{A} = 2 + j$, $\mathbf{B} = 2.5\angle -\pi/3$ and $\mathbf{C} = 0.7\, e^{j150°}$, find $(\mathbf{A} - \mathbf{B})/\mathbf{C}$?

Q19. Answer. $1.3329 - j4.4515 = 4.6467\angle -73.3310°$

Q20. For $\mathbf{A} = 2 + j$, $\mathbf{B} = 2.5\angle -\pi/3$ and $\mathbf{C} = 0.7\, e^{j150°}$, find $\mathbf{B} \cdot (\mathbf{A} + \mathbf{C})$?

Q20. Answer. $4.6651 - j1.3301 = 4.8510\angle -15.9142°$

Q21. Determine $\mathbf{C} = 2\ln(3 + j5)$. Hint: convert $3 + j5$ into polar form ?

Q21. Answer. $3.5264 + j2.0608$

Q22. Determine $\mathbf{X}$ if $\mathbf{X} - j5 = 2/\mathbf{X}$. Hint: remember that the quadratic equation $ax^2 + bx + c = 0$ has two solutions $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$?

Q22. Answer. $0 + j4.5616$ and $0 + j0.4384$

Q23. Determine $\frac{d}{dt}[5\cos(3t) + j4\sin(2t)]$?

Q23. Answer. $-15\sin(3t) + j8\cos(2t)$

Q24. Determine $\frac{d}{d\mathbf{x}}\left[\frac{5}{\mathbf{x}-4}\right]$ at $\mathbf{x} = 2 + j$?

Q24. Answer. $-0.6 - j0.8$

Q25. Determine $\int_0^3 5\, e^{-j4t} dt$?

Q25. Answer. $\frac{5}{-j4}\left[e^{-j4\times 3} - e^0\right] = -0.6707 - j0.1952$

Q26. Determine $\int_{2+j}^{\infty} 5\, \mathbf{x}^{-2} d\mathbf{x}$?

Q26. Answer. $2 - j$

Q27. Prove that $1/j = -j$?

Q27. Answer. Use the rules for division of complex numbers with the help of complex conjugate.