Complex Exponential Function

In Problems 1–4, find the derivative f' of the given function f.

1. $f(z) = z^2 e^{z+i}$

2. $f(z) = \dfrac{3e^{2z} - ie^{-z}}{z^3 - 1 + i}$

3. $f(z) = e^{iz} - e^{-iz}$

4. $f(z) = ie^{1/z}$

In Problems 5–8, write the given expression in terms of x and y.

5. $\left| e^{z^2 - z} \right|$

6. $\arg\left(e^{z - i/z} \right)$

7. $\arg\left(e^{i(z+\bar{z})} \right)$

8. $\overline{ie^z + 1}$

In Problems 9–12, express the given function f in the form $f(z) = u(x,\ y) + iv(x,\ y)$.

9. $f(z) = e^{-iz}$

10. $f(z) = e^{2\bar{z} + i}$

11. $f(z) = e^{z^2}$

12. $f(z) = e^{1/z}$

Complex Logarithmic Function

In Problems 13–18, find all complex values of the given logarithm.

13. $\ln(-5)$

14. $\ln(-ei)$

15. $\ln(-2 + 2i)$

16. $\ln(1 + i)$

17. $\ln\left(\sqrt{2} + \sqrt{6}i\right)$

18. $\ln\left(-\sqrt{3} + i\right)$

In Problems 19–24, write the principal value of the logarithm in the form $a + ib$.

19. $\mathrm{Ln}\,(6 - 6i)$

20. $\mathrm{Ln}\left(-e^2\right)$

21. $\mathrm{Ln}\,(-12 + 5i)$

22. $\mathrm{Ln}\,(3 - 4i)$

23. $\mathrm{Ln}\left[\left(1 + \sqrt{3}i\right)^5\right]$

24. $\mathrm{Ln}\left[(1 + i)^4\right]$

In Problems 25–28, find all complex values of z satisfying the given equation.

25. $e^z = 4i$

26. $e^{1/z} = -1$

27. $e^{z-1} = -ie^3$

28. $e^{2z} + e^z + 1 = 0$