EXERCISES 5

In Exercises 1–4, perform the indicated operations for the resulting complex numbers if the given changes are made in the indicated examples of this section.

1. In Example 1, change 136.3° to 226.3° and then find the exponential form.
2. In Example 2, change the sign before $7.43j$ from $-$ to $+$ and then find the exponential form.
3. In Example 3, change the exponent to $3.80j$ and then find the polar and rectangular forms.
4. In Example 4, change the exponent 2 to 3 and then find the polar and rectangular forms.

In Exercises 5–24, express the given numbers in exponential form.

5. $3.00(\cos 60.0^\circ + j \sin 60.0^\circ)$
6. $575(\cos 135.0^\circ + j \sin 135^\circ)$
7. $0.450(\cos 282.3^\circ + j \sin 282.3^\circ)$
8. $2.10(\cos 588.7^\circ + j \sin 588.7^\circ)$
9. $375.5[\cos(-95.46^\circ) + j \sin(-95.46^\circ)]$
10. $1672[\cos(-7.14^\circ) + j \sin(-7.14^\circ)]$
11. $0.515\angle 198.3^\circ$
12. $4650\angle 326.5^\circ$
13. $4.06\angle -61.4^\circ$
14. $0.0192\angle 76.7^\circ$
15. $9245\angle 296.32^\circ$
16. $82.76\angle 470.09^\circ$
17. $3 - 4j$
18. $-1 - 5j$
19. $-30 + 20j$
20. $100j + 600$
21. $5.90 + 2.40j$
22. $47.3 - 10.9j$
23. $-634.6 - 528.2j$
24. $5477j - 8573$

In Exercises 25–32, express the given complex numbers in polar and rectangular forms.

25. $3.00e^{0.500j}$
26. $20.0e^{1.00j}$
27. $464e^{1.85j}$
28. $2.50e^{3.84j}$
29. $3.20e^{-5.41j}$
30. $0.800e^{3.00j}$
31. $1724e^{2.391j}$
32. $820.7e^{-3.492j}$

In Exercises 33–36, perform the indicated operations and express results in rectangular and polar forms.

33. $(4.55e^{1.32j})^2$
34. $(0.926e^{0.253j})^3$
35. $(625e^{3.46j})(4.40e^{1.22j})$
36. $(18.0e^{5.13j})(25.5e^{0.77j})$

EXERCISES 6

In Exercises 1–4, perform the indicated operations for the resulting complex numbers if the given changes are made in the indicated examples of this section.

1. In Example 1, change the sign of the complex part of the second complex number and then perform the multiplication.
2. In Example 2, multiply the same complex numbers as in Exercise 1.
3. In Example 6, change the exponent to 5 and then find the result.
4. In Example 8, replace $2j$ with $-2j$ and then find the roots.

In Exercises 5–20, perform the indicated operations. Leave the result in polar form.

5. $[4(\cos 60^\circ + j \sin 60^\circ)][2(\cos 20^\circ + j \sin 20^\circ)]$
6. $[3(\cos 120^\circ + j \sin 120^\circ)][5(\cos 45^\circ + j \sin 45^\circ)]$
7. $(0.5\angle 140^\circ)(6\angle 110^\circ)$
8. $(0.4\angle 320^\circ)(5.5\angle -150^\circ)$
9. $\dfrac{8(\cos 100^\circ + j \sin 100^\circ)}{4(\cos 65^\circ + j \sin 65^\circ)}$
10. $\dfrac{[3(\cos 115^\circ + j \sin 115^\circ)]^2}{45(\cos 80^\circ + j \sin 80^\circ)}$
11. $\dfrac{12\angle 320^\circ}{5\angle -210^\circ}$
12. $\dfrac{2\angle 90^\circ}{4\angle 75^\circ}$
13. $[0.2(\cos 35^\circ + j \sin 35^\circ)]^3$
14. $[3(\cos 120^\circ + j \sin 120^\circ)]^4$
15. $(2\angle 135^\circ)^8$
16. $(1\angle 142^\circ)^{10}$
17. $\dfrac{(50\angle 236^\circ)(2\angle 84^\circ)}{125\angle 47^\circ}$
18. $\dfrac{(6\angle 137^\circ)^2}{(2\angle 141^\circ)(6\angle 195^\circ)}$
19. $\dfrac{(4\angle 24^\circ)(10\angle 326^\circ)}{(1\angle 62^\circ)^3(8\angle 77^\circ)}$
20. $\dfrac{(25\angle 194^\circ)(6\angle 239^\circ)}{(30\angle 17^\circ)(10\angle 29^\circ)}$

In Exercises 21–24, perform the indicated operations. Express results in polar form. See Example 5.

21. $2.78\angle 56.8^\circ + 1.37\angle 207.3^\circ$
22. $15.9\angle 142.6^\circ - 18.5\angle 71.4^\circ$
23. $7085\angle 115.62^\circ - 4667\angle 29.34^\circ$
24. $307.5\angle 326.54^\circ + 726.3\angle 96.41^\circ$

In Exercises 25–36, change each number to polar form and then perform the indicated operations. Express the result in rectangular and polar forms. Check by performing the same operation in rectangular form.

25. $(3 + 4j)(5 - 12j)$
26. $(5j - 2)(-1 - j)$
27. $(7 - 3j)(8 + j)$
28. $(1 + 5j)(4 + 2j)$
29. $\dfrac{21}{3 - 9j}$
30. $\dfrac{40j}{2j + 7}$
31. $\dfrac{30 + 40j}{5 - 12j}$
32. $\dfrac{5j - 2}{-1 - j}$
33. $(3 + 4j)^4$
34. $(-1 - j)^8$
35. $(3j + 2)^5$
36. $(1 - 2j)^6$

In Exercises 37–42, use DeMoivre's theorem to find all the indicated roots. Be sure to find all roots.

37. The two square roots of $4(\cos 60^\circ + j \sin 60^\circ)$
38. The three cube roots of $27(\cos 120^\circ + j \sin 120^\circ)$
39. The three cube roots of $3 - 4j$
40. The two square roots of $-5 + 12j$
41. The square roots of $1 + j$
42. The cube roots of $\sqrt{3} + j$

In Exercises 43–48, find all of the roots of the given equations.

43. $x^4 - 1 = 0$
44. $x^3 - 8 = 0$
45. $x^3 + 27j = 0$
46. $x^4 - j = 0$
47. $x^5 + 32 = 0$
48. $x^6 + 8 = 0$

In Exercises 49–58, perform the indicated operations.

49. Using the results of Example 7, find the cube roots of -125.
50. Using the results of Example 8, find the square roots of $32j$.
51. In Example 7, we showed that one cube root of -1 is $\frac{1}{2} - \frac{1}{2}j\sqrt{3}$. Cube this number in rectangular form and show that the result is -1.
52. (W) Explain why the two square roots of a complex number are negatives of each other.