EXERCISES 3

In Exercises 1 and 2, 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 2(a), change the sign of the imaginary part of the second complex number and then add the numbers graphically.
2. In Example 3, change the sign of the imaginary part of the second complex number and do the subtraction graphically.

In Exercises 3–8, locate the given numbers in the complex plane.

3. $2 + 6j$
4. $-5 + j$
5. $-4 - 3j$
6. 10
7. $-3j$
8. $3 - 4j$

In Exercises 9–28, perform the indicated operations graphically. Check them algebraically.

9. $2 + (3 + 4j)$
10. $2j + (-2 + 3j)$
11. $(5 - j) + (3 + 2j)$
12. $(3 - 2j) + (-1 - j)$
13. $5j - (1 - 4j)$
14. $(0.2 - 0.1j) - 0.1$
15. $(2 - 4j) + (j - 2)$
16. $(-1 - 6j) + (3j + 6)$
17. $(3 - 2j) - (4 - 6j)$
18. $(-25 - 40j) - (20 - 55j)$
19. $(80 + 300j) - (260 + 150j)$
20. $(-j - 2) - (-1 - 3j)$
21. $(1.5 - 0.5j) + (3.0 + 2.5j)$
22. $(3.5 + 2.0j) - (1.5j - 4.0)$
23. $(3 - 6j) - (-1 - 8j)$
24. $(-6 - 3j) + (2 - 7j)$
25. $(2j + 1) - 3j - (j + 1)$
26. $(6 - j) - 9 - (2j - 3)$
27. $(j - 6) - j + (j - 7)$
28. $j - (1 - j) + (3 + 2j)$

In Exercises 29–32, show the given number, its negative, and its conjugate on the same coordinate system.

29. $3 + 2j$
30. $4j - 2$
31. $-3 - 5j$
32. $5 - j$

In Exercises 33 and 34, show the numbers $a + bj$, $3(a + bj)$, and $-3(a + bj)$ on the same coordinate system. The multiplication of a complex number by a real number is called **scalar multiplication** *of the complex number.*

33. $3 - j$
34. $-10 - 30j$

(W) *In Exercises 35–38, perform the indicated vector operations graphically on the complex number $2 + 4j$.*

35. Graph the complex number and its conjugate. Describe the relative positions.
36. Add the number and its conjugate. Describe the result.
37. Subtract the conjugate from the number. Describe the result.
38. Graph the number, the number multiplied by j, the number multiplied by j^2, and the number multiplied by j^3 on the same graph. Describe the result of multiplying a complex number by j.

In Exercises 39 and 40, perform the indicated vector additions graphically. Check them algebraically.

39. Two ropes hold a boat at a dock. The tensions in the ropes can be represented by $40 + 10j$ lb and $50 - 25j$ lb. Find the resultant force.
40. Relative to the air, a plane heads north of west with a velocity that can be represented by $-480 + 210j$ km/h. The wind is blowing from south of west with a velocity that can be represented by $60 + 210j$ km/h. Find the resultant velocity of the plane.

EXERCISES 4

In Exercises 1 and 2, change the sign of the real part of the complex number in the indicated example of this section and then perform the indicated operations for the resulting complex number.

1. Example 1
2. Example 3

In Exercises 3–18, represent each complex number graphically and give the polar form of each.

3. $8 + 6j$
4. $-8 - 15j$
5. $30 - 40j$
6. $12j - 5$
7. $3.00j - 2.00$
8. $7.00 - 5.00j$
9. $-0.55 - 0.24j$
10. $460 - 460j$
11. $1 + j\sqrt{3}$
12. $\sqrt{2} - j\sqrt{2}$
13. $3.514 - 7.256j$
14. $95.27j + 62.31$
15. -3
16. 60
17. $9j$
18. $-2j$

In Exercises 19–36, represent each complex number graphically and give the rectangular form of each.

19. $5.00(\cos 54.0° + j \sin 54.0°)$
20. $6(\cos 180° + j \sin 180°)$
21. $160(\cos 150.0° + j \sin 150.0°)$
22. $2.50(\cos 315.0° + j \sin 315.0°)$
23. $3.00(\cos 232.0° + j \sin 232.0°)$
24. $220.8(\cos 155.13° + j \sin 155.13°)$
25. $0.08(\cos 360° + j \sin 360°)$
26. $15(\cos 0° + j \sin 0°)$
27. $120(\cos 270° + j \sin 270°)$
28. $\cos 600.0° + j \sin 600.0°$
29. $4.75\angle 172.8°$
30. $1.50\angle 897.7°$
31. $0.9326\angle 229.54°$
32. $277.8\angle -342.63°$
33. $7.32\angle -270°$
34. $18.3\angle 540.0°$
35. $86.42\angle 94.62°$
36. $4629\angle 182.44°$

In Exercises 37–44, solve the given problems.

37. What is the argument for any negative real number?
38. For $x + yj$, what is the argument if $x = y < 0$?
39. Show that the conjugate of $r\angle\theta$ is $r\angle -\theta$.
40. Find r and $\tan(\theta_{\text{ref}})$ for the complex number $a^b(a + bj)$. $(a > 0)$
41. The voltage of a certain generator is represented by $2.84 - 1.06j$ kV. Write this voltage in polar form.
42. Find the magnitude and direction of a force on a bolt that is represented by $40.5 + 24.5j$ newtons.
43. The electric field intensity of a light wave can be described by $12.4\angle 78.3°$ V/m. Write this in rectangular form.
44. The current in a certain microprocessor circuit is represented by $3.75\angle 15.0°$ μA. Write this in rectangular form.

Answers to Practice Exercises

1. $17(\cos 331.9° + j \sin 331.9°)$
2. $-1.25 + 2.17j$
3. $10\angle 270°$