Name: Key Hr:_____ **Complex Numbers**

Express each number in terms of *i*, and simplify.

1. $\sqrt{-36}$ → $6i$

2. $\sqrt{-100}$ → $10i$

3. $-\sqrt{-81}$ → $-9i$

4. $2\sqrt{-49}$ → $2 \cdot 7i = 14i$

5. $-2\sqrt{-3}$ → $-2i\sqrt{3}$

6. $3\sqrt{-11}$ → $3i\sqrt{11}$

7. $\sqrt{-\frac{1}{4}}$ → $\frac{1}{2}i$

8. $\sqrt{-\frac{16}{25}}$ → $\frac{4}{5}i$

9. $\sqrt{-20}$ → $\sqrt{-1} \cdot \sqrt{4} \cdot \sqrt{5} = 2i\sqrt{5}$

10. $\sqrt{-28}$ → $\sqrt{-1} \cdot \sqrt{4} \cdot \sqrt{7} = 2i\sqrt{7}$

11. $-\sqrt{-10}$ → $-\sqrt{-1}\sqrt{10} = -i\sqrt{10}$

12. $2\sqrt{-75}$ → $2\sqrt{-1}\sqrt{3}\sqrt{25} = 2 \cdot 5 \cdot i\sqrt{3} = 10i\sqrt{3}$

13. $5\sqrt{-8}$ → $5\sqrt{-1}\sqrt{2}\sqrt{4}$ $5 \cdot i \cdot 2\sqrt{2} = 10i\sqrt{2}$

Write each number in terms of *i*, perform the indicated operation, and write the answer in the form a+bi.

14. $\sqrt{-64} + \sqrt{-36}$ → $8i + 6i = 14i$

15. $3\sqrt{-4} + \sqrt{-121}$ → $3 \cdot 2i + 11i$ $6i + 11i = 17i$

16. $\sqrt{-100} - \sqrt{-9}$ → $10i - 3i = 7i$

Simplify the following complex numbers. Write your answer in the form a+bi.

17. $(2-7i)+(-5-2i)$ → $-3-9i$

18. $(-4+5i)+(-3+i)$ → $-7+6i$

19. $(-2+4i)-(6-3i)$ → $-8+7i$

20. $(2-i)-(-5+8i)$ → $7-9i$

21. $(-4-3i)+(9-3i)$ → $5-6i$

22. $(-2-7i)-(-5-9i)$

$-2+5=3$

$-7i+9i=2i$

$3+2i$

23. $(4i)(7i)$

$28i^2 = 28(-1)$

$= \boxed{-28}$

24. $(8i)(7+5i)$

$56i + 40i^2$

$\boxed{56i - 40}$

25. $(-5i)(3-7i)$

$-15i + 35i^2$

$\boxed{-15i - 35}$

26. $(-3i+1)(4+3i)$

$-12i - 9i^2 + 4 + 3i$

$9 - 9i + 4$

$\boxed{13 - 9i}$

27. $(-7+4i)(1-2i)$

$-7 + 14i + 4i - 8i^2$

$-7 + 18i + 8$

$\boxed{1 + 18i}$

28. $(5-3i)^2$

$(5-3i)(5-3i)$

$25 - 15i - 15i + 9i^2$

$25 - 30i - 9$

$\boxed{16 - 30i}$

29. $(4+3i)^2$

$(4+3i)(4+3i)$

$16 + 12i + 12i + 9i^2$

$16 - 9 + 24i$

$\boxed{7 + 24i}$

Factor.

30. $x^2 + 25$

$\boxed{(x+5i)(x-5i)}$

31. $9x^2 + 4$

$\boxed{(3x+2i)(3x-2i)}$

32. $2x^2 + 32$

$2(x^2 + 16)$

$\boxed{2(x+4i)(x-4i)}$

33. $3x^2 + 108$

$3(x^2 + 36)$

$\boxed{3(x+6i)(x-6i)}$

Solve.

34. $3a^2 = -9$

$\frac{3}{3} \quad \frac{3}{3}$

$\sqrt{a^2} = \sqrt{-3}$

$a = \pm\sqrt{-3}$

$\boxed{a = \pm i\sqrt{3}}$

35. $\frac{x^2}{36} = -1(36)$

$\sqrt{x^2} = \sqrt{-36}$

$\boxed{x = \pm 6i}$

36. $x^2 + 36 = 117$

$-36 \quad -36$

$\sqrt{x^2} = \sqrt{81}$

$\boxed{x = \pm 9}$

37. $0 = 64 - 4k^2$

$-64 \quad -64$

$\frac{-64}{-4} = \frac{-4k^2}{-4}$

$\sqrt{16} = \sqrt{k^2}$

$\boxed{k = \pm 4}$

38. $9p^2 = 12p - 11$

$9p^2 - 12p + 11 = 0$

$\frac{12 \pm \sqrt{(-12)^2 - 4(9)(11)}}{2(9)}$

$= \frac{12 \pm \sqrt{-252}}{18} = \frac{12 \pm 6i\sqrt{7}}{18}$

$= \boxed{p = \frac{2 \pm i\sqrt{7}}{3}}$

252 → 4, 2, 9 → $6i\sqrt{7}$

39. $3a^2 + 9 = 7a$

$3a^2 - 7a + 9 = 0$

$\frac{7 \pm \sqrt{49 - 4(3)(9)}}{2(3)}$

$= \frac{7 \pm \sqrt{-59}}{6}$

$\boxed{a = \frac{7 \pm i\sqrt{59}}{6}}$

40. $2 = -2x^2$

$\frac{-2}{-2} \quad \frac{-2}{-2}$

$\sqrt{-1} = \sqrt{x^2}$

$\boxed{x = \pm i}$

41. $4k^2 + 3 = -4k$

$4k^2 + 4k + 3 = 0$

$\frac{-4 \pm \sqrt{16 - 4(4)(3)}}{2(4)}$

$= \frac{-4 \pm \sqrt{-32}}{8}$

$= \frac{-4 \pm 4i\sqrt{2}}{8}$

$= \boxed{\frac{-1 \pm i\sqrt{2}}{2}}$

-32 → 4, 4, 2 → $4i\sqrt{2}$