10.4 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

1. Like radicals have the same _____ and radicand or they can be simplified so that they do.

2. Sometimes two or more radicals that do not appear to be like radicals can be _____ so that they are like radicals.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

3. The radicals $\sqrt{a}$ and $\sqrt[3]{a}$ are like radicals.

4. The radicals $\sqrt{a}$ and $3\sqrt{a}$ are like radicals.

5. The sum $4\sqrt{3}+8\sqrt{5}$ cannot be simplified.

Practice

Simplify the following radical expressions. Assume that all variables represent positive real numbers.

1. $3\sqrt{2}+5\sqrt{2}$
2. $7\sqrt{3}-2\sqrt{3}$
3. $4\sqrt{11}-3\sqrt{11}$
4. $6\sqrt{5}+\sqrt{5}$
5. $8\sqrt{10}-11\sqrt{10}$
6. $6\sqrt{17}-9\sqrt{17}$
7. $4\sqrt[3]{3}+9\sqrt[3]{3}$
8. $11\sqrt[3]{14}-6\sqrt[3]{14}$
9. $6\sqrt{11}-5\sqrt{11}-2\sqrt{11}$
10. $\sqrt{7}+6\sqrt{7}-2\sqrt{7}$
11. $\sqrt{a}+4\sqrt{a}-2\sqrt{a}$
12. $2\sqrt{x}-3\sqrt{x}+7\sqrt{x}$
13. $5\sqrt{x}+3\sqrt{x}-\sqrt{x}$
14. $6\sqrt{xy}-10\sqrt{xy}+\sqrt{xy}$
15. $3\sqrt{2}+5\sqrt{3}-2\sqrt{3}+\sqrt{2}$
16. $\sqrt{5}+\sqrt{4}-2\sqrt{5}+6$
17. $2\sqrt{a}+7\sqrt{b}-6\sqrt{a}+\sqrt{b}$
18. $4\sqrt{x}-3\sqrt{x}+2\sqrt{y}+2\sqrt{x}$
19. $6\sqrt[3]{x}-4\sqrt[3]{y}+7\sqrt[3]{x}+2\sqrt[3]{y}$
20. $5\sqrt[3]{x}+9\sqrt[3]{y}-10\sqrt[3]{y}+4\sqrt[3]{x}$
21. $\sqrt{12}+\sqrt{27}$
22. $\sqrt{32}-\sqrt{18}$
23. $3\sqrt{5}-\sqrt{45}$
24. $2\sqrt{7}+5\sqrt{28}$
25. $3\sqrt[3]{54}+8\sqrt[3]{2}$
26. $2\sqrt[3]{128}+5\sqrt[3]{-54}$
27. $\sqrt{50}-\sqrt{18}-3\sqrt{12}$
28. $2\sqrt{48}-\sqrt{54}+\sqrt{27}$
29. $2\sqrt{20}-\sqrt{45}+\sqrt{36}$
30. $\sqrt{18}-2\sqrt{12}+5\sqrt{2}$

31. $\sqrt{8} - 2\sqrt{3} + \sqrt{27} - \sqrt{72}$

32. $\sqrt{80} + \sqrt{8} - \sqrt{45} + \sqrt{50}$

33. $5\sqrt[3]{16} - 4\sqrt[3]{24} + \sqrt[3]{-250}$

34. $\sqrt[3]{192} - 2\sqrt[3]{128} + \sqrt[3]{-81}$

35. $6\sqrt{2x} - \sqrt{8x}$

36. $5\sqrt{3x} + 2\sqrt{12x}$

37. $5y\sqrt{2y} - y\sqrt{18y}$

38. $9x\sqrt{xy} - x\sqrt{16xy}$

39. $4x\sqrt{3xy} - x\sqrt{12xy} - 2x\sqrt{27xy}$

40. $x\sqrt{32x} - x\sqrt{50x} + 2x\sqrt{18x}$

41. $\sqrt{36x^3} + \sqrt{81x^3}$

42. $\sqrt{4a^2b} + \sqrt{9a^2b}$

43. $\sqrt{16x^3y^4} - \sqrt{25x^3y^4}$

44. $\sqrt{72x^{12}y^{15}} + \sqrt{18x^{12}y^{15}} + \sqrt{2x^{12}y^{15}}$

45. $\sqrt{12x^{10}y^{20}} + \sqrt{27x^{10}y^{20}} - \sqrt{3x^{10}y^{20}}$

46. $\sqrt[3]{8a^{12}} + \sqrt[3]{1000a^{12}}$

47. $\sqrt[3]{-27x^{24}y^6} + \sqrt[3]{-125x^{24}y^6}$

48. $\sqrt[3]{27a^{15}b} + \sqrt[3]{8a^{15}b} + \sqrt[3]{64a^{15}b}$

49. $\sqrt[3]{-16x^9y^{12}} - \sqrt[3]{16x^{12}y^9} + \sqrt[3]{54x^3y^6}$

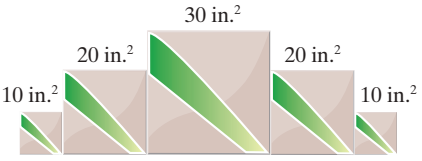
50. $\sqrt[3]{54x^{13}y^3} + \sqrt[3]{8x^{23}y^6} + \sqrt[3]{3x^{13}y^3}$

Applications

Solve.

51. For a complete radio circuit, $d = \sqrt{2g} + \sqrt{2h}$, where d equals the visual horizon distance and g and h are the heights of the radio antennas at the respective stations. What is d when $g = 75$ ft and $h = 85$ ft?

52. Mary is making a tile decoration for her wall. Using square tiles of different sizes, Mary created one decoration that is five tiles across, with sides touching. The first tile is 10 in.^{2}, the second is 20 in.^{2}, the third is 30 in.^{2}, the fourth is 20 in.^{2}, and the fifth is 10 in.^{2} What is the length of the decoration?



53. Josue earns $\sqrt{32t}$ dollars when he works t hours. His roommate, Eric, earns $\sqrt{18t}$ dollars when he works t hours.

a. Find an expression that represents the total income that the two roommates earn after they each work t hours.

b. Find an expression that represents how much more money Josue will earn than Eric after they each work t hours.

Writing & Thinking

Explain the error(s) made in each solution below.

54.
$$\begin{aligned}\sqrt{16} + \sqrt{48} &= \sqrt{16 + 48} \\ &= \sqrt{64} \\ &= 8\end{aligned}$$

55.
$$\begin{aligned}\sqrt[3]{-125} + \sqrt[3]{98} &= \sqrt[3]{-125 + 98} \\ &= \sqrt[3]{-27} \\ &= 3\end{aligned}$$