

A. Simplify the following, always expressing answers in simplest form.

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|--------------------------------------|--------------------------------------|--|--|-------------------------------|----------------------------|--------------------------------------|
| 1. $\sqrt{8bc} \times \sqrt{4bc}$ | 2. $3\sqrt{20} \times 6\sqrt{5}$ | 3. $5 \times 2\sqrt{6}$ | 4. $5\sqrt{10} \times \sqrt{4}$ | | | |
| 5. $\sqrt{5b} \times \sqrt{5b}$ | 6. $\sqrt{2a} \times \sqrt{6a}$ | 7. $\frac{1}{3}\sqrt{3} \times \sqrt{3}$ | 8. $\frac{1}{4}\sqrt{20} \times \frac{4}{5}\sqrt{5}$ | | | |
| 9. $\sqrt{ax} \times \sqrt{ax}$ | 10. $\sqrt{ab^3} \times \sqrt{ac^3}$ | 11. $\sqrt{6r^4} \times \sqrt{3rs^2}$ | 12. $\sqrt{2c^3} \times (-\sqrt{5cd})$ | | | |
| 13. $2m\sqrt{7mn} \times 3\sqrt{7m}$ | 14. $(\sqrt{5})^2$ | 15. $(4\sqrt{6})^2$ | 16. $3y\sqrt{6x^3y} \times 2x\sqrt{8xy^4}$ | | | |
| 17. $(-2\sqrt{x})^2$ | 18. $(x\sqrt{2a})^2$ | 19. $5^3\sqrt{45} \times 2^3\sqrt{3}$ | 20. $\sqrt[4]{18} \times \sqrt[4]{9}$ | | | |
| 21. $\sqrt[5]{486}$ | 22. $2(4\sqrt{2} + 1)$ | 23. $2(3\sqrt{12} - 5\sqrt{8})$ | 24. $\sqrt{2}(\sqrt{3} + 3)$ | | | |
| 25. $\sqrt{8}(2\sqrt{3} - 5)$ | 26. $\sqrt{6}(\sqrt{2} - \sqrt{12})$ | 27. $\sqrt{2}(3\sqrt{2} + \sqrt{18})$ | 28. $\sqrt{12}(2\sqrt{5} - 4\sqrt{2})$ | | | |
| 29. $(\sqrt{2} + 4)(\sqrt{2} - 4)$ | 30. $(2\sqrt{3} - 3)(2\sqrt{3} + 3)$ | 31. $(\sqrt{3} + 4)(\sqrt{3} + 2)$ | 32. $(5 + 3\sqrt{3})(5 + 3\sqrt{3})$ | | | |
| 33. $(2\sqrt{3} - 1)^2$ | 34. $(\sqrt{2} + \sqrt{3})^2$ | 35. $(5\sqrt{6} - 6\sqrt{5})^2$ | 36. $(6\sqrt{5} + \sqrt{7})(6\sqrt{5} - \sqrt{7})$ | | | |
| 37. $\sqrt{\frac{3}{4}}$ | 38. $\sqrt{\frac{15}{64}}$ | 39. $\sqrt{\frac{24}{25}}$ | 40. $\sqrt{2\frac{1}{4}}$ | 41. $\sqrt[3]{\frac{500}{4}}$ | 42. $\sqrt{\frac{d}{m^2}}$ | 43. $\sqrt{\frac{4x^2y}{121a^8b^6}}$ |

B. Simplify.

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|--|---|---|
| 1. $2\sqrt{36} + 2\sqrt{64} - 5\sqrt{12}$ | 2. $4\sqrt{75} + 8\sqrt{12} - 3\sqrt{48}$ | 3. $7\sqrt{120} - 3\sqrt{52} - 2\sqrt{28}$ |
| 4. $8\sqrt{24} + 3\sqrt{6} - 4\sqrt{54}$ | 5. $4\sqrt{243} + 2\sqrt{363} - 5\sqrt{49}$ | 6. $7\sqrt{45} + 4\sqrt{196} - 6\sqrt{125}$ |
| 7. $4^3\sqrt{54} - 7^3\sqrt{128} + 2^3\sqrt{24}$ | 8. $5^3\sqrt{375} + 2^3\sqrt{192} - \sqrt[3]{24}$ | 9. $2^4\sqrt{48} - \sqrt[4]{243}$ |

ANSWERS:

Part A:

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|------------------------------|-----------------------------|---------------------------|------------------------------|-------------------------------|----------------------------|-----------------------------------|
| 1. $4bc\sqrt{2}$ | 2. 180 | 3. $10\sqrt{6}$ | 4. $10\sqrt{10}$ | 5. $5b$ | 6. $2a\sqrt{3}$ | |
| 7. 1 | 8. 2 | 9. ax | 10. $abc\sqrt{bc}$ | 11. $3r^2s\sqrt{2r}$ | 12. $-c^2\sqrt{10d}$ | |
| 13. $42m^2\sqrt{n}$ | 14. 5 | 15. 96 | 16. $24x^3y^3\sqrt{3y}$ | 17. $4x$ | 18. $2ax^2$ | |
| 19. $30^3\sqrt{5}$ | 20. $3^4\sqrt{2}$ | 21. $3^5\sqrt{2}$ | 22. $8\sqrt{2} + 2$ | 23. $12\sqrt{3} - 20\sqrt{2}$ | 24. $\sqrt{6} + 3\sqrt{2}$ | |
| 25. $4\sqrt{6} - 10\sqrt{2}$ | 26. $2\sqrt{3} - 6\sqrt{2}$ | 27. 12 | 28. $4\sqrt{15} - 8\sqrt{6}$ | 29. -14 | 30. 3 | |
| 31. $6\sqrt{3} + 11$ | 32. $52 + 30\sqrt{3}$ | 33. $13 - 4\sqrt{3}$ | 34. $5 + 2\sqrt{6}$ | 35. $330 - 60\sqrt{30}$ | 36. 173 | |
| 37. $\frac{\sqrt{3}}{2}$ | 38. $\frac{\sqrt{15}}{8}$ | 39. $\frac{2\sqrt{6}}{5}$ | 40. $\frac{3}{2}$ | 41. 5 | 42. $\frac{\sqrt{d}}{m}$ | 43. $\frac{2x\sqrt{y}}{11a^4b^3}$ |

Part B:

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|----------------------|----------------------------------|---|------------------|----------------------|
| 1. $28 - 10\sqrt{3}$ | 2. $24\sqrt{3}$ | 3. $14\sqrt{30} - 6\sqrt{13} - 4\sqrt{7}$ | 4. $7\sqrt{6}$ | 5. $58\sqrt{3} - 35$ |
| 6. $56 - 9\sqrt{5}$ | 7. $-16^3\sqrt{2} + 4^3\sqrt{3}$ | 8. $31^3\sqrt{3}$ | 9. $\sqrt[4]{3}$ | |

$$\begin{aligned} \text{A. 1. } & \sqrt{8bc} \times \sqrt{4bc} \\ & = 2\sqrt{2bc} \times 2\sqrt{bc} \\ & = 4\sqrt{2b^2c^2} \\ & = 4bc\sqrt{2} \end{aligned}$$

$$\begin{aligned} 2. & 3\sqrt{20} \times 6\sqrt{5} \\ & = 18\sqrt{4 \times 5 \times 5} \\ & = 18(2)(5) \\ & = 180 \end{aligned}$$

$$\begin{aligned} 3. & 5 \times 2\sqrt{6} \\ & = 10\sqrt{6} \end{aligned}$$

$$\begin{aligned} 4. & 5\sqrt{2} \\ & = 5(2) \\ & = 10\sqrt{0} \end{aligned}$$

$$\begin{aligned} 5. & \sqrt{5b} \times \sqrt{5b} \\ & = 5b \end{aligned}$$

$$\begin{aligned} 6. & \sqrt{2a} \times \sqrt{6a} \\ & = \sqrt{2 \times 2 \times 3 \times a \times a} \\ & = 2a\sqrt{3} \end{aligned}$$

$$\begin{aligned} 7. & \frac{1}{3}\sqrt{3} \times \sqrt{3} \\ & = \frac{1}{3}(3) \\ & = 1 \end{aligned}$$

$$\begin{aligned} 8. & \frac{1}{4}\sqrt{20} \\ & = \frac{1}{5}\sqrt{100} \\ & = \frac{10}{5} \end{aligned}$$

$$\begin{aligned} 9. & \sqrt{ax} \times \sqrt{ax} \\ & = ax \end{aligned}$$

$$\begin{aligned} 10. & \sqrt{ab^3} \times \sqrt{ac^3} \\ & = a\sqrt{b \cdot b} \sqrt{c^2 \cdot c} \\ & = abc\sqrt{bc} \end{aligned}$$

$$\begin{aligned} 11. & \sqrt{6r^4} \sqrt{3rs^2} \\ & = \sqrt{2 \times 3 \times 3 \times r^4 \cdot r \cdot s^2} \\ & = 3r^2s\sqrt{2r} \end{aligned}$$

$$\begin{aligned} 12. & \sqrt{2c^3} \times (-\sqrt{5cd}) \\ & = -\sqrt{10c^4d} \\ & = -c^2\sqrt{10d} \end{aligned}$$

$$\begin{aligned} 13. & 2m\sqrt{7mn} \times 3\sqrt{7m} \\ & = 6m(7m)\sqrt{n} \\ & = 42m^2\sqrt{n} \end{aligned}$$

$$\begin{aligned} 14. & (\sqrt{5})^2 \\ & = 5 \end{aligned}$$

$$\begin{aligned} 15. & (4\sqrt{6})^2 \\ & = (4^2)(6) \\ & = 96 \end{aligned}$$

$$\begin{aligned} 16. & 3y\sqrt{6x^3y} \times 2x\sqrt{8xy^4} \\ & = 6xy\sqrt{16x^3x^4y^4xy} \\ & = 6xy(4x^2y^2)\sqrt{3y} \\ & = 24x^3y^3\sqrt{3y} \end{aligned}$$

$$\begin{aligned} 17. & (-2\sqrt{x})^2 \\ & = (-2)^2(x) \\ & = 4x \end{aligned}$$

$$\begin{aligned} 18. & (x\sqrt{2a})^2 \\ & = x^2(2a) \\ & = 2ax^2 \end{aligned}$$

$$\begin{aligned} 19. & 5\sqrt[3]{45} \times 2\sqrt[3]{3} \\ & = 10\sqrt[3]{9 \times 5 \times 3} \\ & = 10 \times 3\sqrt[3]{5} \\ & = 30\sqrt[3]{5} \end{aligned}$$

$$\begin{aligned} 20. & \sqrt[4]{18} \times \sqrt[4]{9} \\ & = \sqrt[4]{2 \times 3 \times 3 \times 3 \times 3} \\ & = 3\sqrt[4]{2} \end{aligned}$$

$$\begin{aligned} 21. & \sqrt[5]{486} \\ & = \sqrt[5]{2 \times 3^5} \\ & = 3\sqrt[5]{2} \end{aligned}$$

$$\begin{array}{r} 2 \overline{) 486} \\ 3 \overline{) 243} \\ 3 \overline{) 81} \end{array}$$

$$\begin{aligned} 22. & 2(4\sqrt{2} + 1) \\ & = 8\sqrt{2} + 2 \end{aligned}$$

$$\begin{aligned} 23. & 2(3\sqrt{12} - 5\sqrt{8}) \\ & = 2(6\sqrt{3} - 10\sqrt{2}) \\ & = 12\sqrt{3} - 20\sqrt{2} \end{aligned}$$

$$\begin{aligned} 24. & \sqrt{2}(\sqrt{3} + 3) \\ & = \sqrt{6} + 3\sqrt{2} \end{aligned}$$

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$$\begin{aligned} 25. \sqrt{8}(2\sqrt{3}-5) \\ = 2\sqrt{2}(2\sqrt{3}-5) \\ = 4\sqrt{6}-10\sqrt{2} \end{aligned}$$

$$\begin{aligned} 26. \sqrt{6}(\sqrt{2}-\sqrt{12}) \\ = \sqrt{6}(\sqrt{2}-2\sqrt{3}) \\ = \sqrt{3 \times 2 \times 2} - 2\sqrt{2 \times 3 \times 3} \\ = 2\sqrt{3}-6\sqrt{2} \end{aligned}$$

$$\begin{aligned} 27. \sqrt{2}(3\sqrt{2}+\sqrt{18}) \\ = \sqrt{2}(3\sqrt{2}+3\sqrt{2}) \\ = \sqrt{2}(6\sqrt{2}) \\ = 6(2) \\ = 12. \end{aligned}$$

$$\begin{aligned} 28. \sqrt{2}(2\sqrt{5}-4\sqrt{2}) \\ = 2\sqrt{3}(2\sqrt{5}-4\sqrt{2}) \\ = 4\sqrt{15}-8\sqrt{6} \end{aligned}$$

$$\begin{aligned} 29. (\sqrt{2}+4)(\sqrt{2}-4) \\ = 2-16 \\ = -14 \end{aligned}$$

$$\begin{aligned} 30. (2\sqrt{3}-3)(2\sqrt{3}+3) \\ = 4(3)-9 \\ = 12-9 \\ = 3. \end{aligned}$$

$$\begin{aligned} 31. (\sqrt{3}+4)(\sqrt{3}+2) \\ = 3+2\sqrt{3}+4\sqrt{3}+8 \\ = 6\sqrt{3}+11 \end{aligned}$$

$$\begin{aligned} 32. (5+3\sqrt{3})^2 \\ = 25+2(15\sqrt{3})+9(3) \\ = 25+30\sqrt{3}+27 \\ = 52+30\sqrt{3} \end{aligned}$$

$$\begin{aligned} 33. (2\sqrt{3}-1)^2 \\ = 4(3)-4\sqrt{3}+1 \\ = 13-4\sqrt{3} \end{aligned}$$

$$\begin{aligned} 34. (\sqrt{2}+\sqrt{3})^2 \\ = 2+2\sqrt{6}+3 \\ = 5+2\sqrt{6} \end{aligned}$$

$$\begin{aligned} 35. (5\sqrt{6}-6\sqrt{5})^2 \\ = 25(6)-2(30\sqrt{30})+36(5) \\ = 150-60\sqrt{30}+180 \\ = 330-60\sqrt{30} \end{aligned}$$

$$\begin{aligned} 36. (6\sqrt{5}+7)(6\sqrt{5}-7) \\ = 36(5)-49 \\ = 180-49 \\ = 131 \end{aligned}$$

$$\begin{aligned} 37. \sqrt{\frac{3}{4}} \\ = \frac{\sqrt{3}}{\sqrt{4}} \\ = \frac{\sqrt{3}}{2} \end{aligned}$$

$$\begin{aligned} 38. \sqrt{\frac{15}{64}} \\ = \frac{\sqrt{15}}{\sqrt{64}} \\ = \frac{\sqrt{15}}{8} \end{aligned}$$

$$\begin{aligned} 39. \sqrt{\frac{24}{25}} \\ = \frac{\sqrt{24}}{\sqrt{25}} \\ = \frac{2\sqrt{6}}{5} \end{aligned}$$

$$\begin{aligned} 40. \sqrt{\frac{1}{24}} \\ = \frac{\sqrt{1}}{\sqrt{24}} \\ = \frac{\sqrt{9}}{\sqrt{4}} \\ = \frac{\sqrt{9}}{14} \\ = \frac{3}{2} \end{aligned}$$

$$\begin{aligned} 41. \sqrt[3]{\frac{500}{4}} \\ = \sqrt[3]{125} \\ = 5 \end{aligned}$$

$$\begin{aligned} 42. \sqrt{\frac{d}{m^2}} \\ = \frac{\sqrt{d}}{\sqrt{m^2}} \\ = \frac{\sqrt{d}}{m} \end{aligned}$$

$$\begin{aligned} 43. \sqrt{\frac{4x^2y}{121a^8b^6}} \\ = \frac{\sqrt{4x^2y}}{\sqrt{121a^8b^6}} \\ = \frac{2x\sqrt{y}}{11a^4b^3} \end{aligned}$$

Part B.

$$\begin{aligned} 1. 2\sqrt{36}+2\sqrt{64}-5\sqrt{12} \\ = 2(6)+2(8)-5(2\sqrt{3}) \\ = 12+16-10\sqrt{3} \\ = 28-10\sqrt{3} \end{aligned}$$

$$\begin{aligned} 2. 4\sqrt{75}+8\sqrt{12}-3\sqrt{48} \\ = 4(5\sqrt{3})+8(2\sqrt{3})-3(4\sqrt{3}) \\ = 20\sqrt{3}+16\sqrt{3}-12\sqrt{3} \\ = 24\sqrt{3} \end{aligned}$$

$$\begin{aligned} 3. 7\sqrt{120}-3\sqrt{52}-2\sqrt{28} \\ = 7\sqrt{4 \times 30}-3\sqrt{4 \times 13}-2\sqrt{4 \times 7} \\ = 14\sqrt{30}-6\sqrt{13}-4\sqrt{7} \end{aligned}$$

$$\begin{aligned} 4. 8\sqrt{24}+3\sqrt{6}-4\sqrt{54} \\ = 8\sqrt{4 \times 6}+3\sqrt{6}-4\sqrt{9 \times 6} \\ = 16\sqrt{6}+3\sqrt{6}-12\sqrt{6} \\ = 7\sqrt{6} \end{aligned}$$

U2D1 Worksheet Radicals extra practice solutions ⁴ $\frac{196}{49}$

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$$\begin{aligned}
 5. \quad & 4\sqrt{243} + 2\sqrt{363} - 5\sqrt{49} \\
 &= 4\sqrt{81 \times 3} + 2\sqrt{121 \times 3} - 5(7) \\
 &= 4(9\sqrt{3}) + 2(11\sqrt{3}) - 35 \\
 &= 36\sqrt{3} + 22\sqrt{3} - 35 \\
 &= 58\sqrt{3} - 35
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & 7\sqrt{45} + 4\sqrt{196} - 6\sqrt{125} \\
 &= 7\sqrt{9 \times 5} + 4\sqrt{4 \times 49} - 6\sqrt{25 \times 5} \\
 &= 7(3\sqrt{5}) + 4(2)(7) - 6(5\sqrt{5}) \\
 &= 21\sqrt{5} + 56 - 30\sqrt{5} \\
 &= 56 - 9\sqrt{5}
 \end{aligned}$$

³ $\frac{192}{64}$

$$\begin{aligned}
 7. \quad & 4\sqrt[3]{54} - 7\sqrt[3]{128} + 2\sqrt[3]{24} \\
 &= 4\sqrt[3]{27 \times 2} - 7\sqrt[3]{64 \times 2} + 2\sqrt[3]{8 \times 3} \\
 &= 4(3\sqrt[3]{2}) - 7(4\sqrt[3]{2}) + 2(2\sqrt[3]{3}) \\
 &= 12\sqrt[3]{2} - 28\sqrt[3]{2} + 4\sqrt[3]{3} \\
 &= -16\sqrt[3]{2} + 4\sqrt[3]{3}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & 5\sqrt[3]{375} + 2\sqrt[3]{192} - \sqrt[3]{24} \\
 &= 5\sqrt[3]{125 \times 3} + 2\sqrt[3]{64 \times 3} - \sqrt[3]{8 \times 3} \\
 &= 5(5\sqrt[3]{3}) + 2(4\sqrt[3]{3}) - 2\sqrt[3]{3} \\
 &= 25\sqrt[3]{3} + 8\sqrt[3]{3} - 2\sqrt[3]{3} \\
 &= 31\sqrt[3]{3}
 \end{aligned}$$

$$\begin{aligned}
 9. \quad & 2\sqrt[4]{48} - \sqrt[4]{243} \\
 &= 2\sqrt[4]{16 \times 3} - \sqrt[4]{81 \times 3} \\
 &= 2(2\sqrt[4]{3}) - 3\sqrt[4]{3} \\
 &= 4\sqrt[4]{3} - 3\sqrt[4]{3} \\
 &= \sqrt[4]{3}
 \end{aligned}$$