

Addition and Subtraction of Square Roots

Simplify each of the following:

$$1. \quad 5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$$

$$2. \quad 7\sqrt{5} + 11\sqrt{5} = 18\sqrt{5}$$

$$3. \quad -4\sqrt{21} - 7\sqrt{21} = -11\sqrt{21}$$

$$4. \quad 5\sqrt{2} + \sqrt{72} = 5\sqrt{2} + \sqrt{2^3 \cdot 3^2} = 5\sqrt{2} + 2 \cdot 3\sqrt{2} = 5\sqrt{2} + 6\sqrt{2} = 11\sqrt{2}$$

$$5. \quad 2\sqrt{75} - \sqrt{3} = 2\sqrt{3 \cdot 5^2} - \sqrt{3} = 2 \cdot 5\sqrt{3} - \sqrt{3} = 10\sqrt{3} - \sqrt{3} = 9\sqrt{3}$$

$$6. \quad -4\sqrt{5} + \sqrt{45} = -4\sqrt{5} + \sqrt{3^2 \cdot 5} = -4\sqrt{5} + 3\sqrt{5} = -\sqrt{5}$$

$$7. \quad 3\sqrt{12} - \sqrt{50} = 3\sqrt{2^2 \cdot 3} - \sqrt{2 \cdot 5^2} = 3 \cdot 2\sqrt{3} - 5\sqrt{2} = 6\sqrt{3} - 5\sqrt{2}$$

$$8. \quad \sqrt{81} - \sqrt{36} = \sqrt{3^4} - \sqrt{2^2 \cdot 3^2} = 3^2 - 2 \cdot 3 = 9 - 6 = 3$$

$$9. \quad \sqrt{32} + 4\sqrt{8} = \sqrt{2^5} + 4\sqrt{2^3} = 2^2\sqrt{2} + 4 \cdot 2\sqrt{2} = 4\sqrt{2} + 8\sqrt{2} = 12\sqrt{2}$$

$$10. \quad -2\sqrt{147} - \sqrt{27} = -2\sqrt{3 \cdot 7^2} - \sqrt{3^3} = -2 \cdot 7\sqrt{3} - 3\sqrt{3} = -14\sqrt{3} - 3\sqrt{3} = -17\sqrt{3}$$

$$11. \quad \sqrt{125} + \sqrt{405} = \sqrt{5^3} + \sqrt{3^4 \cdot 5} = 5\sqrt{5} + 3^2\sqrt{5} = 5\sqrt{5} + 9\sqrt{5} = 14\sqrt{5}$$

$$12. \quad \sqrt{144} - \sqrt{54} = \sqrt{2^4 \cdot 3^2} - \sqrt{2 \cdot 3^3} = 2^2 \cdot 3 - 3\sqrt{2 \cdot 3} = 12 - 3\sqrt{6}$$

$$13. \quad 5\sqrt{17} + 7\sqrt{6} - \sqrt{17} = 4\sqrt{17} + 7\sqrt{6}$$

$$14. \quad \begin{aligned} 4\sqrt{28} + 2\sqrt{7} - \sqrt{14} &= 4\sqrt{2^2 \cdot 7} + 2\sqrt{7} - \sqrt{2 \cdot 7} = 4 \cdot 2\sqrt{7} + 2\sqrt{7} - \sqrt{2 \cdot 7} = \\ 8\sqrt{7} + 2\sqrt{7} - \sqrt{14} &= 10\sqrt{7} - \sqrt{14} \end{aligned}$$

$$15. \quad \begin{aligned} \sqrt{48} - \sqrt{192} + \sqrt{12} &= \sqrt{2^4 \cdot 3} - \sqrt{2^6 \cdot 3} + \sqrt{2^2 \cdot 3} = 2^2\sqrt{3} - 2^3\sqrt{3} + 2\sqrt{3} = \\ 4\sqrt{3} - 8\sqrt{3} + 2\sqrt{3} &= -2\sqrt{3} \end{aligned}$$

$$16. \quad \begin{aligned} -3\sqrt{5} + 4\sqrt{180} + 2\sqrt{27} &= -3\sqrt{5} + 4\sqrt{2^2 \cdot 3^2 \cdot 5} + 2\sqrt{3^3} = -3\sqrt{5} + 4 \cdot 2 \cdot 3\sqrt{5} + 2 \cdot 3\sqrt{3} = \\ -3\sqrt{5} + 24\sqrt{5} + 6\sqrt{3} &= 21\sqrt{5} + 6\sqrt{3} \end{aligned}$$

17. $\sqrt{50} + \sqrt{18} - \sqrt{8} = \sqrt{2 \cdot 5^2} + \sqrt{2 \cdot 3^2} - \sqrt{2^3} = 5\sqrt{2} + 3\sqrt{2} - 2\sqrt{2} = 6\sqrt{2}$
18. $\sqrt{45} - \sqrt{20} + \sqrt{125} = \sqrt{3^2 \cdot 5} - \sqrt{2^2 \cdot 5} + \sqrt{5^3} = 3\sqrt{5} - 2\sqrt{5} + 5\sqrt{5} = 6\sqrt{5}$
19. $\sqrt{27} - \sqrt{75} + \sqrt{48} = \sqrt{3^3} - \sqrt{3 \cdot 5^2} + \sqrt{2^4 \cdot 3} = 3\sqrt{3} - 5\sqrt{3} + 2^2\sqrt{3} = 3\sqrt{3} - 5\sqrt{3} + 4\sqrt{3} = 2\sqrt{3}$
20. $\sqrt{18} + \sqrt{24} - \sqrt{54} = \sqrt{2 \cdot 3^2} + \sqrt{2^3 \cdot 3} - \sqrt{2 \cdot 3^3} = 3\sqrt{2} + 2\sqrt{2 \cdot 3} - 3\sqrt{2 \cdot 3} =$
 $3\sqrt{2} + 2\sqrt{6} - 3\sqrt{6} = 3\sqrt{2} - \sqrt{6}$
21. $\sqrt{28} - 2\sqrt{98} + \sqrt{63} = \sqrt{2^2 \cdot 7} - 2\sqrt{2 \cdot 7^2} + \sqrt{3^2 \cdot 7} = 2\sqrt{7} - 2 \cdot 7\sqrt{2} + 3\sqrt{7} =$
 $2\sqrt{7} - 14\sqrt{2} + 3\sqrt{7} = 5\sqrt{7} - 14\sqrt{2}$
22. $\sqrt{24} + \sqrt{150} - \sqrt{96} = \sqrt{2^3 \cdot 3} + \sqrt{2 \cdot 3 \cdot 5^2} - \sqrt{2^5 \cdot 3} = 2\sqrt{2 \cdot 3} + 5\sqrt{2 \cdot 3} - 2^2\sqrt{2 \cdot 3} =$
 $2\sqrt{6} + 5\sqrt{6} - 4\sqrt{6} = 3\sqrt{6}$
23. $4\sqrt{5} + \sqrt{80} + \sqrt{20} = 4\sqrt{5} + \sqrt{2^4 \cdot 5} + \sqrt{2^2 \cdot 5} = 4\sqrt{5} + 2^2\sqrt{5} + 2\sqrt{5} = 4\sqrt{5} + 4\sqrt{5} + 2\sqrt{5} = 10\sqrt{5}$
24. $\sqrt{243} + \sqrt{75} - \sqrt{300} = \sqrt{3^5} + \sqrt{3 \cdot 5^2} - \sqrt{2^2 \cdot 3 \cdot 5^2} = 3^2\sqrt{3} + 5\sqrt{3} - 2 \cdot 5\sqrt{3} =$
 $9\sqrt{3} + 5\sqrt{3} - 10\sqrt{3} = 4\sqrt{3}$
25. $3x\sqrt{y} - 2x\sqrt{y} = x\sqrt{y}$
26. $5\sqrt{x^3y} - 7x\sqrt{xy} = 5x\sqrt{xy} - 7x\sqrt{xy} = 2x\sqrt{xy}$
27. $4\sqrt{x^5y^3} + 2x^2\sqrt{xy^3} - 7xy\sqrt{x^3y} = 4x^2y\sqrt{xy} + 2x^2y\sqrt{xy} - 7x^2y\sqrt{xy} = -x^2y\sqrt{xy}$
28. $\sqrt{m^3n^5} + mn\sqrt{mn^3} - n^2\sqrt{m^3n} = mn^2\sqrt{mn} + mn^2\sqrt{mn} - mn^2\sqrt{mn} = mn^2\sqrt{mn}$
29. $9\sqrt{x^4y^6z^{11}} - 3xy^2z^4\sqrt{xy^4z^3} = 9x^2y^3z^5\sqrt{z} - 3xy^2z^4 \cdot y^2 \cdot z\sqrt{xz} = 9x^2y^3z^5\sqrt{z} - 3xy^4z^5\sqrt{xz}$
30. $12\sqrt{x^7y^6} + 2xy^3\sqrt{x^5} - 5x^3y^3\sqrt{x} = 12x^3y^3\sqrt{x} + 2xy^3 \cdot x^2\sqrt{x} - 5x^3y^3\sqrt{x} =$
 $12x^3y^3\sqrt{x} + 2x^3y^3\sqrt{x} - 5x^3y^3\sqrt{x} = 9x^3y^3\sqrt{x}$