

6.3 Adding and Subtracting Radicals

Adding & Subtracting Radicals	1 SIMPLIFY all radicals	
	2 Identify radicals with the SAME INDEX and SAME RADICAND . Only these can be combined!	
	3 For common radicals, add/subtract the coefficients and KEEP THE COMMON RADICAL	
	1. $3\sqrt{27} - 2\sqrt{12}$ $3 \cdot 3\sqrt{3} - 2 \cdot 2\sqrt{3}$ $9\sqrt{3} - 4\sqrt{3}$ $5\sqrt{3}$	2. $3\sqrt[3]{54} - 2\sqrt[3]{2} + 7\sqrt[3]{-16}$ $3 \cdot 3\sqrt[3]{2} - 2\sqrt[3]{2} + 7 \cdot -2\sqrt[3]{2}$ $9\sqrt[3]{2} - 2\sqrt[3]{2} - 14\sqrt[3]{2}$ $-7\sqrt[3]{2}$
	3. $7\sqrt[3]{48} - 2\sqrt[3]{3} + 3\sqrt[3]{72}$ $7 \cdot 2\sqrt[3]{3} - 2\sqrt[3]{3} + 3 \cdot 2\sqrt[3]{9}$ $14\sqrt[3]{3} - 2\sqrt[3]{3} + 6\sqrt[3]{9}$ $12\sqrt[3]{3} + 6\sqrt[3]{9}$	4. $10\sqrt{28} + \sqrt[3]{-56} - 4\sqrt{175}$ $10 \cdot 2\sqrt{7} + -2\sqrt[3]{7} - 4 \cdot 5\sqrt{7}$ $20\sqrt{7} - 2\sqrt[3]{7} - 20\sqrt{7}$ $-2\sqrt[3]{7}$
	5. $\sqrt{98x^4y^2} - 3xy\sqrt{2}$ $7x^2y\sqrt{2} - 3xy\sqrt{2}$ $4x^2y\sqrt{2}$	6. $\sqrt[3]{-40a^7} + 2a^2 \cdot \sqrt[3]{135a^4}$ $-2a^2\sqrt[3]{5a} + 2a^2 \cdot 3a\sqrt[3]{5a}$ $-2a^2\sqrt[3]{5a} + 6a^3\sqrt[3]{5a}$ $(6a^3 - 2a^2)\sqrt[3]{5a}$
Binomial Examples	7. $\sqrt{10}(5\sqrt{5} - 2\sqrt{2})$ $5\sqrt{50} - 2\sqrt{20}$ $5 \cdot 5\sqrt{2} - 2 \cdot 2\sqrt{5}$ $25\sqrt{2} - 4\sqrt{5}$	8. $(8 - \sqrt{10})(3 - \sqrt{10})$ $24 - 8\sqrt{10} - 3\sqrt{10} + 10$ $34 - 11\sqrt{10}$
	9. $(6\sqrt{6} - 6\sqrt{2})(\sqrt{6} + \sqrt{2})$ $6 \cdot 6 + 6\sqrt{12} - 6\sqrt{12} - 6 \cdot 2$ $36 - 12$ 24	10. $(4 - \sqrt{5})^2 (4 - \sqrt{5})(4 - \sqrt{5})$ $16 - 4\sqrt{5} - 4\sqrt{5} + 5$ $21 - 8\sqrt{5}$

$$11. \sqrt{3k}(\sqrt{12k} - 2\sqrt{15k^2})$$

$$\sqrt{36k^2} - 2\sqrt{45k^3}$$

$$6k - 2 \cdot 3k\sqrt{5k}$$

$$6k - 6k\sqrt{5k}$$

$$12. (\sqrt{x} - \sqrt{8})(\sqrt{x} + \sqrt{2})$$

$$\sqrt{x^2} + \sqrt{2x} - \sqrt{8x} - \sqrt{16}$$

$$x + \sqrt{2x} - \sqrt{8x} - 4$$

$$x + \sqrt{2x} - 2\sqrt{2x} - 4$$

$$x - \sqrt{2x} - 4$$

13. Find the area and perimeter of the rectangle shown to the left.

$$A = (4 - \sqrt{6})(7\sqrt{6} + \sqrt{3})$$

$$28\sqrt{6} + 4\sqrt{3} = 7 \cdot 6 - \sqrt{18}$$

$$28\sqrt{6} + 4\sqrt{3} - 42 - 3\sqrt{2}$$

$$-2\sqrt{2} + 2\sqrt{6}$$

$$P = 2(4 - \sqrt{6}) + 2(7\sqrt{6} + \sqrt{3})$$

$$8 - 2\sqrt{6} + 14\sqrt{6} + 2\sqrt{3}$$

$$8 + 12\sqrt{6} + 2\sqrt{3}$$

$$(4 - \sqrt{6})$$



$$(7\sqrt{6} + \sqrt{3})$$

Rationalizing the Denominator

Binomial Denominator: Multiply the numerator and denominator by the conjugate.

$$14. \frac{4}{4+\sqrt{2}} \frac{(4-\sqrt{2})}{(4-\sqrt{2})} = \frac{16-4\sqrt{2}}{16-4\sqrt{2}+4\sqrt{2}-2}$$

$$\frac{16-4\sqrt{2}}{14} = \frac{8-2\sqrt{2}}{7}$$

$$15. \frac{2}{6-\sqrt{5}} \frac{(6+\sqrt{5})}{(6+\sqrt{5})} = \frac{12+2\sqrt{5}}{36-6\sqrt{5}+6\sqrt{5}-5}$$

$$\frac{12+2\sqrt{5}}{31}$$

$$16. \frac{\sqrt{3}}{1-4\sqrt{2}} \frac{(1+4\sqrt{2})}{(1+4\sqrt{2})} = \frac{\sqrt{3}+4\sqrt{6}}{1+4\sqrt{2}-4\sqrt{2}-16 \cdot 2}$$

$$\frac{\sqrt{3}+4\sqrt{6}}{1-32} = \frac{\sqrt{3}+4\sqrt{6}}{-31}$$

$$17. \frac{5-\sqrt{5}}{\sqrt{5}+\sqrt{3}} \frac{(\sqrt{5}-\sqrt{3})}{(\sqrt{5}-\sqrt{3})} = \frac{5\sqrt{5}-5\sqrt{3}-5+\sqrt{15}}{5-\sqrt{15}+\sqrt{15}-3}$$

$$= \frac{-5-5\sqrt{3}+5\sqrt{5}+\sqrt{15}}{2}$$

$$18. \frac{3+\sqrt{7}(2-2\sqrt{7})}{2+2\sqrt{7}(2-2\sqrt{7})}$$

$$6 - 6\sqrt{7} + 2\sqrt{7} - 2 \cdot 7$$

$$4 - 4\sqrt{7} + 4\sqrt{7} - 4 \cdot 7$$

$$= \frac{6 - 4\sqrt{7} - 14}{4 - 28} = \frac{-8 - 4\sqrt{7}}{-24}$$

$$\frac{2 + \sqrt{7}}{6}$$

$$19. \frac{8-\sqrt{6}}{3-4\sqrt{6}} \frac{(3+4\sqrt{6})}{(3+4\sqrt{6})}$$

$$24 + 32\sqrt{6} - 3\sqrt{6} - 4 \cdot 6$$

$$9 + 12\sqrt{6} - 12\sqrt{6} - 16 \cdot 6$$

$$= \frac{24 + 29\sqrt{6} - 24}{9 - 96} = \frac{29\sqrt{6}}{-87}$$

$$\frac{\sqrt{6}}{-3}$$