

Adding and Subtracting Radical Expressions

Name: _____ Date: _____ Score: _____ / 36

Q Quick Review

Adding radicals follows the same logic as adding x -terms: combine *like* pieces, leave *unlike* pieces alone.

Like radicals. Same index *and* same radicand. $3\sqrt{5}$ and $-2\sqrt{5}$ are like; combine to $(3 - 2)\sqrt{5} = \sqrt{5}$. $3\sqrt{5}$ and $3\sqrt{2}$ are *not* like — the radicands differ. $3\sqrt{5}$ and $3\sqrt[3]{5}$ are also not like — the indices differ.

Simplify first — then look for like radicals. Most problems hide the like-ness. $\sqrt{12} + \sqrt{27}$ looks like two unrelated radicals until you simplify: $2\sqrt{3} + 3\sqrt{3} = 5\sqrt{3}$. The expression $4\sqrt{2} + 3\sqrt{8} - \sqrt{18}$ shrinks to $4\sqrt{2} + 6\sqrt{2} - 3\sqrt{2} = 7\sqrt{2}$ after every radical is reduced to $\sqrt{2}$ form.

Coefficients add, radicands stay. The arithmetic happens on the coefficients alone: $a\sqrt{r} + b\sqrt{r} = (a + b)\sqrt{r}$. The radicand never sums — it just rides along.

Variable radicals. The same rule applies with x, y inside. Pull out the perfect powers first; check the radicand after simplification. Quick check: $2\sqrt{50x^3} - x\sqrt{18x} = 10x\sqrt{2x} - 3x\sqrt{2x} = 7x\sqrt{2x}$ (for $x \geq 0$).

Common slips. Treating $\sqrt{a} + \sqrt{b}$ as $\sqrt{a + b}$ (wrong — the same trap as in multiplication, just flipped). Adding the radicands instead of the coefficients. Stopping before simplifying each radical and missing a chance to combine.

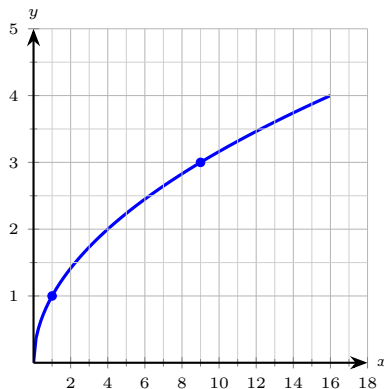
PRACTICE

Simplify each radical first, then combine like terms. Different radicands or indices don't combine.

1. Simplify $3\sqrt{5} + 2\sqrt{5}$. _____
2. Simplify $7\sqrt{3} - 4\sqrt{3}$. _____
3. Simplify $\sqrt{12} + \sqrt{27}$. _____
4. Simplify $4\sqrt{2} + 3\sqrt{8} - \sqrt{18}$. _____
5. Simplify $5\sqrt{2} + 3\sqrt{3}$. _____
6. Simplify $2\sqrt{50x^3} - x\sqrt{18x}$ for $x \geq 0$. _____
7. Simplify $\sqrt{75} + 2\sqrt{12} - \sqrt{48}$. _____
8. Mark TRUE or FALSE: $\sqrt{a} + \sqrt{b} = \sqrt{a + b}$. _____
9. Simplify $4\sqrt{20} - 3\sqrt{45} + 2\sqrt{5}$. _____
10. Simplify $\sqrt{32y^3} + 3y\sqrt{18y} - 5\sqrt{8y^3}$ for $y \geq 0$. _____



11. The graph shows $f(x) = \sqrt{x}$ with two lattice points marked. Use it to read $f(16)$, the value of $\sqrt{16}$. _____



12. Simplify $5\sqrt{6} - 2\sqrt{6} + \sqrt{6}$. _____

13. Simplify $\sqrt[3]{16} + \sqrt[3]{54}$. _____

14. Mark TRUE or FALSE: $\sqrt{a^2} + \sqrt{b^2} = a + b$ for all real a, b . _____

15. Simplify $3\sqrt{50} + 4\sqrt{8} - \sqrt{18}$. _____

16. Simplify $\sqrt{45} - 2\sqrt{20} + \sqrt{125}$. _____

17. Simplify $2\sqrt{27} + 5\sqrt{75} - \sqrt{12}$. _____

18. Simplify $6\sqrt{x} - 4\sqrt{x} + \sqrt{x}$ for $x \geq 0$. _____

19. The table gives $g(x) = \sqrt{x}$ at several perfect squares. Following the pattern, find $g(100)$. _____

x	16	36	64	81
$g(x)$	4	6	8	9

20. Simplify $a\sqrt{27a} + \sqrt{12a^3}$ for $a \geq 0$. _____

◆ Word Problems

21. A triangle has side lengths $\sqrt{8}$, $\sqrt{32}$, and $\sqrt{50}$ inches. Find its exact perimeter in simplified radical form. _____

22. Three pipes have lengths $\sqrt{75}$ ft, $2\sqrt{48}$ ft, and $\sqrt{27}$ ft. Find their exact total length in simplified radical form. _____

23. A rectangle has dimensions $\sqrt{50}$ by $\sqrt{18}$ feet. Find the exact perimeter in simplified radical form. _____

24. Two streets meet at a right angle. A diagonal shortcut walks $\sqrt{180}$ m, then continues along another diagonal of $\sqrt{45}$ m. A third diagonal of $\sqrt{20}$ m completes the trip. Find the exact total distance walked, in simplified radical form. _____

Additional Practice

25. Simplify $\sqrt{72}$. _____

26. Simplify $\sqrt{45}$. _____

27. Simplify $\sqrt[3]{64}$. _____

28. Solve $\sqrt{x+5} = 9$. _____

29. Solve $\sqrt{x} - 3 = 4$. _____



30. Domain of $y = \sqrt{x - 6}$. _____

31. Add $3\sqrt{5} + 2\sqrt{5}$. _____

32. Multiply $\sqrt{3} \cdot \sqrt{12}$. _____

33. Rationalize $\frac{4}{\sqrt{2}}$. _____

34. Write $x^{3/2}$ using radicals. _____

35. Simplify $(\sqrt{7})^2$. _____

36. Solve $\sqrt{x + 1} < 4$. _____



Answer Keys

1. $5\sqrt{5}$
 2. $3\sqrt{3}$
 3. $5\sqrt{3}$
 4. $7\sqrt{2}$
 5. $5\sqrt{2} + 3\sqrt{3}$
 6. $7x\sqrt{2x}$
 7. $5\sqrt{3}$
 8. FALSE
 9. $\sqrt{5}$
 10. $3y\sqrt{2y}$
 11. 4
 12. $4\sqrt{6}$

Additional Practice Answers

25. $6\sqrt{2}$
 26. $3\sqrt{5}$
 27. 4
 28. $x = 76$
 29. $x = 49$
 30. $x \geq 6$
13. $5\sqrt[3]{2}$
 14. FALSE
 15. $20\sqrt{2}$
 16. $4\sqrt{5}$
 17. $29\sqrt{3}$
 18. $3\sqrt{x}$
 19. 10
 20. $5a\sqrt{3a}$
 21. $11\sqrt{2}$ in
 22. $16\sqrt{3}$ ft
 23. $16\sqrt{2}$ ft
 24. $11\sqrt{5}$ m
31. $5\sqrt{5}$
 32. 6
 33. $2\sqrt{2}$
 34. $\sqrt{x^3}$
 35. 7
 36. $-1 \leq x < 15$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. Both terms are like radicals — same index, same radicand $\sqrt{5}$ — so add the coefficients and keep the radical unchanged: $(3 + 2)\sqrt{5} = 5\sqrt{5}$. Think of $\sqrt{5}$ as a common unit, just like adding $3x + 2x = 5x$.
2. Same radicand $\sqrt{3}$ in both terms, so they're like radicals — subtract the coefficients and keep the radical: $(7 - 4)\sqrt{3} = 3\sqrt{3}$. The radicand itself never changes during addition or subtraction.
3. Reduce each first: $\sqrt{12} = 2\sqrt{3}$ and $\sqrt{27} = 3\sqrt{3}$. Then $2\sqrt{3} + 3\sqrt{3} = 5\sqrt{3}$. The $\sqrt{3}$ form emerges only after simplifying.
4. Simplify each radical to the same form first: $3\sqrt{8} = 3 \cdot 2\sqrt{2} = 6\sqrt{2}$ and $\sqrt{18} = 3\sqrt{2}$, while $4\sqrt{2}$ is already there. Now all three are like radicals: $4\sqrt{2} + 6\sqrt{2} - 3\sqrt{2} = 7\sqrt{2}$.
5. Different radicands; neither simplifies further. The expression is already in simplest form. (Don't merge unlike radicals — the result wouldn't equal the original.)
6. Keep the rule visible: $2\sqrt{50x^3} = 2 \cdot 5x\sqrt{2x} = 10x\sqrt{2x}$. $x\sqrt{18x} = x \cdot 3\sqrt{2x} = 3x\sqrt{2x}$. Subtract: $10x\sqrt{2x} - 3x\sqrt{2x} = 7x\sqrt{2x}$. That gives a quick check on the answer.
7. Reduce every term to $\sqrt{3}$ form: $\sqrt{75} = 5\sqrt{3}$, $2\sqrt{12} = 2 \cdot 2\sqrt{3} = 4\sqrt{3}$, and $\sqrt{48} = 4\sqrt{3}$. Then combine like radicals: $5\sqrt{3} + 4\sqrt{3} - 4\sqrt{3} = 5\sqrt{3}$. The last two cancel, so only the first term survives.
8. Radicals don't distribute over addition. $\sqrt{9} + \sqrt{16} = 3 + 4 = 7$, but $\sqrt{9 + 16} = \sqrt{25} = 5$. Different numbers.
9. Simplify each radical to $\sqrt{5}$ form: $4\sqrt{20} = 4 \cdot 2\sqrt{5} = 8\sqrt{5}$ and $3\sqrt{45} = 3 \cdot 3\sqrt{5} = 9\sqrt{5}$; $2\sqrt{5}$ is already simplified. Combine the coefficients: $8 - 9 + 2 = 1$, so the result is $1\sqrt{5} = \sqrt{5}$.
10. Keep the rule visible: $\sqrt{32y^3} = 4y\sqrt{2y}$; $3y\sqrt{18y} = 9y\sqrt{2y}$; $5\sqrt{8y^3} = 10y\sqrt{2y}$. Combine: $(4 + 9 - 10)y\sqrt{2y} = 3y\sqrt{2y}$. That gives a quick check on the answer.
11. Trace up from $x = 16$ to the curve, then across to the y -axis: the height is 4, since $\sqrt{16} = 4$. The marked points (1, 1) and (9, 3) set the scale — the square-root curve keeps climbing but flattens as x grows.
12. All three terms share the radical $\sqrt{6}$, so just combine the coefficients left to right: $5 - 2 + 1 = 4$, giving $4\sqrt{6}$. No simplifying was needed first — the radicals were already alike.

13. Simplify each cube root first: $16 = 8 \cdot 2$ so $\sqrt[3]{16} = 2\sqrt[3]{2}$, and $54 = 27 \cdot 2$ so $\sqrt[3]{54} = 3\sqrt[3]{2}$. Now both are like radicals (same index 3, same radicand 2), so add the coefficients: $2\sqrt[3]{2} + 3\sqrt[3]{2} = 5\sqrt[3]{2}$.
14. Keep the rule visible: $\sqrt{a^2} = |a|$, not a . So the left side is $|a| + |b|$. For positive a, b they match; for negatives they don't. That gives a quick check on the answer.
15. One steady path is: $3\sqrt{50} = 15\sqrt{2}$; $4\sqrt{8} = 8\sqrt{2}$; $\sqrt{18} = 3\sqrt{2}$. Combine: $15 + 8 - 3 = 20$, giving $20\sqrt{2}$. That gives a quick check on the answer.
16. Start with the key idea: $\sqrt{45} = 3\sqrt{5}$; $2\sqrt{20} = 4\sqrt{5}$; $\sqrt{125} = 5\sqrt{5}$. Combine: $3 - 4 + 5 = 4$, so $4\sqrt{5}$. That gives a quick check on the answer.
17. A careful way to see it: $2\sqrt{27} = 6\sqrt{3}$; $5\sqrt{75} = 25\sqrt{3}$; $\sqrt{12} = 2\sqrt{3}$. Combine: $6 + 25 - 2 = 29$, so $29\sqrt{3}$. That gives a quick check on the answer.
18. Each term carries the same radical \sqrt{x} , so they're like radicals — combine the coefficients: $6 - 4 + 1 = 3$, giving $3\sqrt{x}$. The $x \geq 0$ condition guarantees \sqrt{x} is defined throughout.
19. Each entry maps a perfect square to its root: $g(81) = 9$ because $9^2 = 81$. Since $100 = 10^2$, the pattern continues to $g(100) = 10$. (The table stops short of $x = 100$ on purpose — extend the pattern yourself.)
20. Start with the key idea: $a\sqrt{27a} = a \cdot 3\sqrt{3a} = 3a\sqrt{3a}$; $\sqrt{12a^3} = 2a\sqrt{3a}$. Combine: $3a\sqrt{3a} + 2a\sqrt{3a} = 5a\sqrt{3a}$. That gives a quick check on the answer.
21. Simplify each side: $\sqrt{8} = 2\sqrt{2}$; $\sqrt{32} = 4\sqrt{2}$; $\sqrt{50} = 5\sqrt{2}$. Perimeter = $2\sqrt{2} + 4\sqrt{2} + 5\sqrt{2} = 11\sqrt{2}$ in. (Decimal sanity: $11 \cdot 1.414 \approx 15.55$, consistent with three positive lengths.)
22. Keep the rule visible: $\sqrt{75} = 5\sqrt{3}$; $2\sqrt{48} = 8\sqrt{3}$; $\sqrt{27} = 3\sqrt{3}$. Sum: $5 + 8 + 3 = 16$, giving $16\sqrt{3}$ ft. (Reducing each radical first uncovers the common $\sqrt{3}$ — without that, the three lengths look unrelated.) That gives a quick check on the answer.
23. One steady path is: $\sqrt{50} = 5\sqrt{2}$; $\sqrt{18} = 3\sqrt{2}$. Perimeter = $2(5\sqrt{2} + 3\sqrt{2}) = 2(8\sqrt{2}) = 16\sqrt{2}$ ft. (Bonus check: the area is $\sqrt{50} \cdot \sqrt{18} = \sqrt{900} = 30$ ft² exactly.) That gives a quick check on the answer.
24. Simplify each diagonal: $\sqrt{180} = 6\sqrt{5}$; $\sqrt{45} = 3\sqrt{5}$; $\sqrt{20} = 2\sqrt{5}$. Total = $6 + 3 + 2 = 11$, so $11\sqrt{5}$ m. Numerically, $11 \cdot 2.236 \approx 24.6$ m — reasonable for three short walking diagonals.



Build Algebra Confidence From Pre-Algebra Through Algebra II



The Complete Algebra Success Bundle

Pre-Algebra, Algebra I, and Algebra II in one clear path

Friendly lessons, focused practice, and full-review support for every stage.



Scan for the Bundle

6 Books
3 Courses
1 Path

Bundle Value: Six coordinated books help students review missing skills, learn new algebra topics, and practice until the steps feel natural.

Complete Course Path

- ✓ Starts with Pre-Algebra foundations
- ✓ Moves smoothly into Algebra I skills
- ✓ Extends learning through Algebra II topics
- ✓ Great for review, tutoring, and summer study

One bundle, one steady path.

Step-by-Step Lessons

- ✓ Plain-English explanations students can follow
- ✓ Worked examples that show every important step
- ✓ Common mistakes called out before they stick
- ✓ Skill-building practice after each lesson
- ✓ Helpful for independent study or class support

Less guessing. More understanding.

Practice That Sticks

- ✓ Matching practice workbooks for extra repetition
- ✓ Review sets to keep older skills fresh
- ✓ Answer explanations for checking thinking
- ✓ Strong support before tests and final exams
- ✓ Designed to build fluency and confidence

Practice today. Remember tomorrow.

STUDENT FAVORITE • Master Algebra II From the Ground Up



Algebra II for Beginners

Written by a top math teacher & aligned with national and state Algebra II courses. From polynomial functions to logarithms, trigonometry, and rational expressions — explained the easy way.

- ✓ **Complete coverage** of every Algebra II concept — perfect companion to these worksheets
- ✓ **Step-by-step explanations** with worked examples on every topic
- ✓ **QR codes in every chapter** for free video lessons & bonus practice
- ✓ **2 full-length practice tests** with detailed answer keys

- ✓ 100% Guaranteed
- ✓ Lifetime Support
- ✓ Trusted by Teachers

Start Your Algebra Journey Today! →

PDF EDITION



Instant download • any device

PAPERBACK



Paperback on Amazon

Hold it in your hands

★ STUDENT'S #1 CHOICE ★

Teacher-recommended • 12,000+ Happy Students

Pair these free worksheets with *Algebra II for Beginners* and you have a complete self-paced course — concept lessons, daily practice, and full exam-style reviews, all in one path. → EffortlessMath.com/product/algebra-ii-for-beginners