Printable Rules for Square Roots and Radicals: Reference and Practice

Core Radical Rules

Boxed rules panel: product rule, quotient rule, perfect-square extraction, simplified-form checklist, and the five-step procedure.

Product rule: for nonnegative factors a and b, sqrt(a*b) = sqrt(a)*sqrt(b). This rule lets you split a radicand into a perfect-square factor and a remaining factor.

Quotient rule: for a nonnegative numerator and a positive denominator, sqrt(a/b) = sqrt(a)/sqrt(b). This rule lets you separate a fraction inside a radical, but the denominator must be positive and the final expression must not leave a radical in the denominator.

Perfect-square extraction: if the radicand contains a factor that is a perfect square, replace that factor's square root with its integer value. For example, sqrt(72) = sqrt(36*2) = sqrt(36)*sqrt(2) = 6*sqrt(2).

Simplified form checklist: no perfect-square factor greater than 1 remains inside the radical; no fraction remains inside the radical; no radical remains in a denominator. Squaring the simplified expression must recover the original radicand.

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Worked Examples

Three worked-example boxes: sqrt(50), sqrt(18/25), sqrt(12)*sqrt(3).

Example 1: Simplify sqrt(50). Factor 50 as 25*2. Then sqrt(50) = sqrt(25)*sqrt(2) = 5*sqrt(2). Check: (5*sqrt(2))^2 = 25*2 = 50.

Example 2: Simplify sqrt(18/25). Apply the quotient rule: sqrt(18)/sqrt(25) = sqrt(18)/5. Then sqrt(18) = sqrt(9*2) = 3*sqrt(2), so the result is (3*sqrt(2))/5. Check: ((3*sqrt(2))/5)^2 = (9*2)/25 = 18/25.

Example 3: Simplify sqrt(12)*sqrt(3). By the product rule, sqrt(12)*sqrt(3) = sqrt(36) = 6. Check: 6^2 = 36 and 12*3 = 36.

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Radical Convention Diagram

Convention diagram: radical sign covers the entire radicand; vinculum extends over all terms inside. Alternative letter styles accepted when radicand boundary is clear and expression is mathematically equivalent.

The radical sign covers the entire radicand, and the horizontal bar extends over all terms inside. Alternative letter styles are acceptable if the radicand boundary is clear and the expression is mathematically equivalent.

A simplified radical has no perfect-square factor greater than 1 in the radicand, no fraction inside the radical, and no radical in a denominator.

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Common Mistakes and Fixes

Four mistake/fix pairs.

Mistake: Splitting a sum inside a radical: writing sqrt(9+16) as sqrt(9)+sqrt(16). Fix: The product and quotient rules apply to multiplication and division, not addition. Compute the sum first: sqrt(25)=5, not 3+4=7.

Mistake: Leaving a perfect-square factor inside the radical, such as sqrt(48)=sqrt(16*3) without extracting 4. Fix: Extract every perfect-square factor: sqrt(48)=4*sqrt(3). Check by squaring: (4*sqrt(3))^2=16*3=48.

Mistake: Leaving a radical in the denominator, such as 1/sqrt(2). Fix: Rationalize by multiplying numerator and denominator by sqrt(2): 1/sqrt(2)=sqrt(2)/2. Check: (sqrt(2)/2)^2=2/4=1/2.

Mistake: Applying the quotient rule with a negative or zero denominator. Fix: The quotient rule requires a positive denominator. State the domain restriction before simplifying.

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FAQ

Three FAQ pairs.

Q: Does the product rule work for negative radicands? A: No. The product rule sqrt(a*b)=sqrt(a)*sqrt(b) requires both factors to be nonnegative. For negative radicands, the expression is not a real number in this reference.

Q: How do I know a radical is fully simplified? A: Check three conditions: no perfect-square factor greater than 1 remains inside the radical, no fraction remains inside the radical, and no radical remains in a denominator. Squaring the result must recover the original radicand.

Q: Can I simplify sqrt(8)/sqrt(2) by dividing first? A: Yes. sqrt(8)/sqrt(2)=sqrt(8/2)=sqrt(4)=2. Check: 2^2=4 and 8/2=4.

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Worked Example: sqrt(75)

Distinct from the four practice tasks.

Simplify sqrt(75) and check the result by squaring.

sqrt(75)=5*sqrt(3). Check: (5*sqrt(3))^2=25*3=75.

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Rubric

Seven rubric criteria.

States the product rule, quotient rule, and perfect-square extraction rule correctly.

Applies each rule to a numerical example with correct arithmetic.

Extracts all perfect-square factors greater than 1 from the radicand.

Removes fractions from inside radicals and radicals from denominators.

Checks the simplified expression by squaring and comparing to the original radicand.

Uses the defined radical convention: the radical sign covers the entire radicand, and the vinculum extends over all terms inside. Accepts valid alternative handwritten letter styles when the radicand boundary is clear and the expression is mathematically equivalent.