

Chapter 11 - Unlocking Radical Expressions and Triangles

Objective: I can simplify square roots, cube roots, and radical expressions by extracting perfect powers.

For Questions 1-6, simplify completely. Assume variables are nonnegative.

1. Simplify $\sqrt{72}$.	2. Simplify $\sqrt{180}$.
3. Simplify $\sqrt{48x^3}$.	4. Simplify $\sqrt[3]{54}$.
5. Simplify $\sqrt{50a^2b^3}$.	6. Simplify $\frac{\sqrt{48}}{\sqrt{3}}$.

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Objective: I can add, subtract, multiply, and square radical expressions accurately.

Simplify every radical before combining like terms.

7. Simplify $3\sqrt{5} + 7\sqrt{5} - 2\sqrt{5}$.	8. Simplify $4\sqrt{12} - \sqrt{27}$.
9. Simplify $2\sqrt{8} + 3\sqrt{18}$.	10. Simplify $\sqrt{6}(\sqrt{15} - 2\sqrt{6})$.
11. Simplify $(\sqrt{7} + 3)(\sqrt{7} - 3)$.	12. Expand and simplify $(2\sqrt{3} + \sqrt{5})^2$.

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Objective: I can rationalize denominators and simplify radical quotients completely.

Leave no radical in a denominator.

13. Rationalize and simplify $\frac{5}{\sqrt{3}}$.	14. Rationalize and simplify $\frac{7}{2\sqrt{5}}$.
15. Rationalize $\frac{3}{\sqrt{6} + \sqrt{2}}$.	16. Rationalize and simplify $\frac{4}{3 - \sqrt{5}}$.
17. Simplify $\frac{6\sqrt{2}}{3\sqrt{8}}$.	18. Simplify and rationalize $\frac{\sqrt{12}}{\sqrt{18}}$.

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Objective: I can solve radical equations and reject extraneous solutions by substitution.

State domain restrictions and check every candidate in the original equation.

19. Solve $\sqrt{x+5} = 6$.	20. Solve $\sqrt{2x-1} = x-2$.
21. Solve $\sqrt{x+9} + 1 = x$.	22. Solve $\sqrt{3x+4} = x+2$.
23. Solve $\sqrt{x+1} = \sqrt{2x-5}$.	24. Solve $\sqrt{x+2} + \sqrt{x-1} = 3$.

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Objective: I can apply the Pythagorean Theorem and classify triangles from their side lengths.

Give exact answers and show the square comparison used for classification.

25. A right triangle has legs 6 and 8. Find its hypotenuse.	26. A right triangle has hypotenuse 13 and one leg 5. Find the other leg.
27. A right triangle has legs 7 and 11. Find the exact hypotenuse.	28. A right triangle has hypotenuse 20 and one leg 12. Find the other leg.
29. Classify the triangle with side lengths 8, 15, and 17. Justify.	30. Classify the triangle with side lengths 7, 9, and 12 as acute, right, or obtuse.

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Objective: I can use right-triangle structure, square relationships, and similarity to determine unknown lengths.

Write the equation or proportion before solving.

31. A right triangle has legs x and $x + 7$ and hypotenuse 17. Find both legs.	32. An isosceles triangle has equal sides 13 and base 10. Find its altitude to the base.
33. Find the diagonal of a rectangle with side lengths 9 and 12.	34. A square has area 98. Find the exact length of its diagonal.
35. A 6-8-10 triangle is similar to a triangle with hypotenuse 25. Find the larger triangle's legs.	36. Two triangles are similar. A side of 4 corresponds to 10, and a side of 6 corresponds to x. Find x.

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Objective: I can model distances and measurements with right triangles and exact radicals.

Identify the hypotenuse and label units in every answer.

37. A 15-ft ladder rests with its foot 9 ft from a wall. How high up the wall does it reach?	38. A ramp rises 5 ft over a horizontal distance of 12 ft. Find the ramp's length.
39. A wire runs from the top of a 24-ft pole to an anchor 10 ft from its base. Find the wire's length.	40. A rectangular screen measures 15 in. by 8 in. Find its diagonal.
41. A boat travels 9 km east and then 12 km north. Find its direct distance from the starting point.	42. A baseball diamond is a square with side 90 ft. Find the home-to-second-base distance to the nearest tenth.
43. A square has area 200 square units. Find its exact side length.	44. A cube has edge length 6. Find the exact diagonal of one square face.

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Objective: I can combine radical simplification and triangle reasoning in multi-step problems.

Show a complete derivation and simplify every exact answer.

45. Find the exact area of an equilateral triangle with side length 12.	46. An isosceles triangle has equal sides 10 and base 12. Find its area.
47. Two perpendicular roads are 20 km and 21 km long. How much shorter is the direct route between their endpoints?	48. A student claims $\sqrt{a+b} = \sqrt{a} + \sqrt{b}$. Use $a = 9$, $b = 16$ to analyze the claim.
49. Honors challenge: Simplify $\sqrt{7+4\sqrt{3}}$ by recognizing a hidden perfect square.	50. Honors challenge: Solve $\sqrt{x+4} + \sqrt{9-x} = 5$ and check all candidates.

Other topics for review:

- Extract all perfect powers before declaring a radical expression simplified.
- Only radicals with identical radicands and indices are like radicals.
- Squaring an equation can create extraneous solutions, so checking is essential.
- In a right triangle, the hypotenuse is opposite the right angle and is the longest side.
- Exact radical answers should be preserved unless an approximation is specifically requested.