

Simplifying Radicals Worksheet

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Perfect-square factors · largest square first

Name _____ Date _____ Score _____

/ 30

HOW TO SIMPLIFY A RADICAL

1. Split the number inside into a perfect square times whatever is left: $\sqrt{72} = \sqrt{36 \times 2}$.
2. Take the root of the perfect square outside: $= 6\sqrt{2}$.
3. Keep going until no perfect square is left inside, and no radical is left in a denominator.

Useful: $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$ and $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$. But $\sqrt{a} + \sqrt{b}$ is *not* $\sqrt{a+b}$.

SECTION A Pull out the perfect square

Find the largest perfect-square factor, take its root outside, leave the rest inside.

1 $\sqrt{12}$

Answer _____

2 $\sqrt{50}$

Answer _____

3 $\sqrt{72}$

Answer _____

4 $\sqrt{45}$

Answer _____

5 $\sqrt{98}$

Answer _____

6 $\sqrt{200}$

Answer _____

7 $\sqrt{75}$

Answer _____

8 $\sqrt{162}$

Answer _____

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Radicals with variables · assume every variable is positive

SECTION B Radicals with variables

Assume every variable is positive. Pairs come out: $\sqrt{x^2} = x$, $\sqrt{x^3} = x\sqrt{x}$.

9 $\sqrt{x^4}$

Answer

10 $\sqrt{x^5}$

Answer

11 $\sqrt{9x^2}$

Answer

12 $\sqrt{18x^3}$

Answer

13 $\sqrt{50x^4y^2}$

Answer

14 $\sqrt{48a^5}$

Answer

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Multiplying, dividing and rationalising

SECTION C Multiplying radicals

 $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$. Multiply first, then simplify what you get.

15 $\sqrt{3} \cdot \sqrt{12}$

Answer

16 $\sqrt{6} \cdot \sqrt{8}$

Answer

17 $2\sqrt{5} \cdot 3\sqrt{10}$

Answer

18 $\sqrt{2} \cdot \sqrt{18}$

Answer

19 $(3\sqrt{2})^2$

Answer

20 $\sqrt{x} \cdot \sqrt{x^3}$

Answer

SECTION D Dividing and rationalising

 $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$. No radical may be left in a denominator — multiply top and bottom by it.

21 $\frac{\sqrt{50}}{\sqrt{2}}$

Answer

22 $\sqrt{\frac{49}{16}}$

Answer

23 $\frac{1}{\sqrt{3}}$

Answer

24 $\frac{6}{\sqrt{2}}$

Answer

25 $\frac{\sqrt{20}}{\sqrt{5}}$

Answer

26 $\frac{5}{\sqrt{10}}$

Answer

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Combining like radicals and reasoning

SECTION E Adding and subtracting like radicals

Only radicals with the *same* number inside can be combined. Simplify each term first — terms that look different often are not.

27 $3\sqrt{5} + 4\sqrt{5}$

Answer

29 $\sqrt{27} - \sqrt{12}$

Answer

28 $\sqrt{8} + \sqrt{18}$

Answer

30 $2\sqrt{50} + \sqrt{32}$

Answer

SECTION F Explain your reasoning

A sentence or two each.

31 A student writes $\sqrt{8} + \sqrt{2} = \sqrt{10}$. Explain why that is wrong, and give the correct answer.

Answer

32 Why is $\frac{1}{\sqrt{3}}$ usually rewritten as $\frac{\sqrt{3}}{3}$, when both are the same number?

Answer

THE MISTAKE TO AVOID

Treating $\sqrt{}$ as if it distributes over addition. It distributes over multiplication and division only. Test it: $\sqrt{9+16} = \sqrt{25} = 5$, but $\sqrt{9} + \sqrt{16} = 3 + 4 = 7$.

Answer Key

ANSWER KEY · PAGE 1 OF 3

Each simplification verified numerically at build time.

SECTION A

$$1. \sqrt{12} = 2\sqrt{3} \quad 4 \times 3$$

$$3. \sqrt{72} = 6\sqrt{2} \quad 36 \times 2$$

$$5. \sqrt{98} = 7\sqrt{2} \quad 49 \times 2$$

$$7. \sqrt{75} = 5\sqrt{3} \quad 25 \times 3$$

$$2. \sqrt{50} = 5\sqrt{2} \quad 25 \times 2$$

$$4. \sqrt{45} = 3\sqrt{5} \quad 9 \times 5$$

$$6. \sqrt{200} = 10\sqrt{2} \quad 100 \times 2$$

$$8. \sqrt{162} = 9\sqrt{2} \quad 81 \times 2$$

SECTION B

$$9. \sqrt{x^4} = x^2$$

$$11. \sqrt{9x^2} = 3x$$

$$13. \sqrt{50x^4y^2} = 5x^2y\sqrt{2}$$

$$10. \sqrt{x^5} = x^2\sqrt{x}$$

$$12. \sqrt{18x^3} = 3x\sqrt{2x}$$

$$14. \sqrt{48a^5} = 4a^2\sqrt{3a}$$

Answer Key

ANSWER KEY · PAGE 2 OF 3

Each simplification verified numerically at build time.

SECTION C

15. $\sqrt{3} \cdot \sqrt{12} = 6$

16. $\sqrt{6} \cdot \sqrt{8} = 4\sqrt{3}$

17. $2\sqrt{5} \cdot 3\sqrt{10} = 30\sqrt{2}$

18. $\sqrt{2} \cdot \sqrt{18} = 6$

19. $(3\sqrt{2})^2 = 18$

20. $\sqrt{x} \cdot \sqrt{x^3} = x^2$

SECTION D

21. $\frac{\sqrt{50}}{\sqrt{2}} = 5$

22. $\sqrt{\frac{49}{16}} = \frac{7}{4}$

23. $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3} \quad \times \frac{\sqrt{3}}{\sqrt{3}}$

24. $\frac{6}{\sqrt{2}} = 3\sqrt{2} \quad \times \frac{\sqrt{2}}{\sqrt{2}}$

25. $\frac{\sqrt{20}}{\sqrt{5}} = 2$

26. $\frac{5}{\sqrt{10}} = \frac{\sqrt{10}}{2} \quad \times \frac{\sqrt{10}}{\sqrt{10}}$

Answer Key

ANSWER KEY · PAGE 3 OF 3

Each simplification verified numerically at build time.

SECTION E

$$27. 3\sqrt{5} + 4\sqrt{5} = 7\sqrt{5}$$

$$29. \sqrt{27} - \sqrt{12} = \sqrt{3} \quad 3\sqrt{3} - 2\sqrt{3}$$

$$28. \sqrt{8} + \sqrt{18} = 5\sqrt{2} \quad 2\sqrt{2} + 3\sqrt{2}$$

$$30. 2\sqrt{50} + \sqrt{32} = 14\sqrt{2} \quad 10\sqrt{2} + 4\sqrt{2}$$

SECTION F

31. Square roots do not add that way — $\sqrt{a} + \sqrt{b} \neq \sqrt{a+b}$. Checking numerically, $\sqrt{8} + \sqrt{2} \approx 4.24$ but $\sqrt{10} \approx 3.16$. Simplify first: $\sqrt{8} = 2\sqrt{2}$, so $2\sqrt{2} + \sqrt{2} = 3\sqrt{2}$.

32. They are equal — both are about 0.577. The convention exists because a rational denominator is easier to compare, combine with other fractions and estimate by hand. Multiplying top and bottom by $\sqrt{3}$ changes the form, not the value.