

Algebra 2 Radicals and Rational Exponents Workbook



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Simplifying Radicals

WORKED EXAMPLE

$$\sqrt{350}$$

$$\begin{aligned} 350 &= 25 \times 14 \\ &= \sqrt{25} \times \sqrt{14} \\ &= 5\sqrt{14} \end{aligned}$$

1. Simplifying radicals

Simplify each square root.

1 $\sqrt{63}$

2 $\sqrt{126}$

3 $\sqrt{360}$

4 $\sqrt{224}$

5 $\sqrt{56}$

6 $\sqrt{125}$

7 $\sqrt{8}$

8 $\sqrt{32}$

9 $\sqrt{486}$

10 $\sqrt{24}$

11 $\sqrt{72}$

12 $\sqrt{96}$

13 $\sqrt{12}$

14 $\sqrt{175}$

15 $\sqrt{135}$

16 $\sqrt{112}$

17 $\sqrt{504}$

18 $\sqrt{75}$

19 $\sqrt{52}$

20 $\sqrt{98}$

21 $\sqrt{90}$

22 $\sqrt{300}$

23 $\sqrt{44}$

24 $\sqrt{128}$

25 $\sqrt{48}$

26 $\sqrt{240}$

27 $\sqrt{539}$

28 $\sqrt{99}$

WORKED EXAMPLE

$$\sqrt[3]{56}$$

$$\begin{aligned} 56 &= 8 \times 7 \\ &= \sqrt[3]{8} \times \sqrt[3]{7} \\ &= 2\sqrt[3]{7} \end{aligned}$$

2. Simplifying radicals

Simplify each cube root.

1 $\sqrt[3]{40}$

2 $\sqrt[3]{297}$

3 $\sqrt[3]{48}$

4 $\sqrt[3]{250}$

5 $\sqrt[3]{54}$

6 $\sqrt[3]{320}$

7 $\sqrt[3]{96}$

8 $\sqrt[3]{625}$

9 $\sqrt[3]{243}$

10 $\sqrt[3]{108}$

11 $\sqrt[3]{640}$

12 $\sqrt[3]{88}$

13 $\sqrt[3]{324}$

14 $\sqrt[3]{375}$

15 $\sqrt[3]{80}$

16 $\sqrt[3]{128}$

17 $\sqrt[3]{81}$

18 $\sqrt[3]{875}$

19 $\sqrt[3]{256}$

20 $\sqrt[3]{24}$

21 $\sqrt[3]{750}$

22 $\sqrt[3]{192}$

23 $\sqrt[3]{16}$

24 $\sqrt[3]{768}$

Rational Exponents

WORKED EXAMPLE

$$216^{1/3} = \underline{6}$$

$$\sqrt[3]{216} = 6$$

$$= \sqrt[3]{216}$$

$$= 6$$

3. Rational exponents

Work out each one. Take the root first, then raise it.

1 $216^{2/3} = \underline{\hspace{2cm}}$

2 $4^{3/2} = \underline{\hspace{2cm}}$

3 $1000^{4/3} = \underline{\hspace{2cm}}$

4 $256^{1/4} = \underline{\hspace{2cm}}$

5 $729^{4/3} = \underline{\hspace{2cm}}$

6 $100^{1/2} = \underline{\hspace{2cm}}$

7 $6561^{1/4} = \underline{\hspace{2cm}}$

8 $64^{5/3} = \underline{\hspace{2cm}}$

9 $10000^{1/4} = \underline{\hspace{2cm}}$

10 $16^{3/4} = \underline{\hspace{2cm}}$

11 $729^{1/3} = \underline{\hspace{2cm}}$

12 $512^{1/3} = \underline{\hspace{2cm}}$

13 $256^{5/4} = \underline{\hspace{2cm}}$

14 $1000^{1/3} = \underline{\hspace{2cm}}$

15 $25^{1/2} = \underline{\hspace{2cm}}$

16 $2401^{1/4} = \underline{\hspace{2cm}}$

17 $81^{5/4} = \underline{\hspace{2cm}}$

18 $512^{4/3} = \underline{\hspace{2cm}}$

19 $100^{3/2} = \underline{\hspace{2cm}}$

20 $1296^{5/4} = \underline{\hspace{2cm}}$

21 $625^{3/4} = \underline{\hspace{2cm}}$

22 $125^{1/3} = \underline{\hspace{2cm}}$

23 $1296^{1/4} = \underline{\hspace{2cm}}$

24 $4096^{1/4} = \underline{\hspace{2cm}}$

25 $25^{5/2} = \underline{\hspace{2cm}}$

26 $64^{3/2} = \underline{\hspace{2cm}}$

27 $625^{1/4} = \underline{\hspace{2cm}}$

28 $64^{1/2} = \underline{\hspace{2cm}}$

Answer Key

Simplifying Radicals

Simplifying radicals

1. $\sqrt{63} = 3\sqrt{7}$
2. $\sqrt{126} = 3\sqrt{14}$
3. $\sqrt{360} = 6\sqrt{10}$
4. $\sqrt{224} = 4\sqrt{14}$
5. $\sqrt{56} = 2\sqrt{14}$
6. $\sqrt{125} = 5\sqrt{5}$
7. $\sqrt{8} = 2\sqrt{2}$
8. $\sqrt{32} = 4\sqrt{2}$
9. $\sqrt{486} = 9\sqrt{6}$
10. $\sqrt{24} = 2\sqrt{6}$
11. $\sqrt{72} = 6\sqrt{2}$
12. $\sqrt{96} = 4\sqrt{6}$
13. $\sqrt{12} = 2\sqrt{3}$
14. $\sqrt{175} = 5\sqrt{7}$
15. $\sqrt{135} = 3\sqrt{15}$
16. $\sqrt{112} = 4\sqrt{7}$
17. $\sqrt{504} = 6\sqrt{14}$
18. $\sqrt{75} = 5\sqrt{3}$
19. $\sqrt{52} = 2\sqrt{13}$
20. $\sqrt{98} = 7\sqrt{2}$
21. $\sqrt{90} = 3\sqrt{10}$
22. $\sqrt{300} = 10\sqrt{3}$
23. $\sqrt{44} = 2\sqrt{11}$
24. $\sqrt{128} = 8\sqrt{2}$
25. $\sqrt{48} = 4\sqrt{3}$
26. $\sqrt{240} = 4\sqrt{15}$
27. $\sqrt{539} = 7\sqrt{11}$
28. $\sqrt{99} = 3\sqrt{11}$

Cube Roots

Simplifying radicals

1. $\sqrt[3]{40} = 2\sqrt[3]{5}$
2. $\sqrt[3]{297} = 3\sqrt[3]{11}$
3. $\sqrt[3]{48} = 2\sqrt[3]{6}$
4. $\sqrt[3]{250} = 5\sqrt[3]{2}$
5. $\sqrt[3]{54} = 3\sqrt[3]{2}$
6. $\sqrt[3]{320} = 4\sqrt[3]{5}$
7. $\sqrt[3]{96} = 2\sqrt[3]{12}$
8. $\sqrt[3]{625} = 5\sqrt[3]{5}$
9. $\sqrt[3]{243} = 3\sqrt[3]{9}$
10. $\sqrt[3]{108} = 3\sqrt[3]{4}$
11. $\sqrt[3]{640} = 4\sqrt[3]{10}$
12. $\sqrt[3]{88} = 2\sqrt[3]{11}$
13. $\sqrt[3]{324} = 3\sqrt[3]{12}$
14. $\sqrt[3]{375} = 5\sqrt[3]{3}$
15. $\sqrt[3]{80} = 2\sqrt[3]{10}$

Cube Roots (continued)

Simplifying radicals (continued)

16. $\sqrt[3]{128} = 4\sqrt[3]{2}$
17. $\sqrt[3]{81} = 3\sqrt[3]{3}$
18. $\sqrt[3]{875} = 5\sqrt[3]{7}$
19. $\sqrt[3]{256} = 4\sqrt[3]{4}$
20. $\sqrt[3]{24} = 2\sqrt[3]{3}$
21. $\sqrt[3]{750} = 5\sqrt[3]{6}$
22. $\sqrt[3]{192} = 4\sqrt[3]{3}$
23. $\sqrt[3]{16} = 2\sqrt[3]{2}$
24. $\sqrt[3]{768} = 4\sqrt[3]{12}$

Rational Exponents

Rational exponents

1. $216^{(2/3)} = 36$
2. $4^{(3/2)} = 8$
3. $1000^{(4/3)} = 10000$
4. $256^{(1/4)} = 4$
5. $729^{(4/3)} = 6561$
6. $100^{(1/2)} = 10$
7. $6561^{(1/4)} = 9$
8. $64^{(5/3)} = 1024$
9. $10000^{(1/4)} = 10$
10. $16^{(3/4)} = 8$
11. $729^{(1/3)} = 9$
12. $512^{(1/3)} = 8$
13. $256^{(5/4)} = 1024$
14. $1000^{(1/3)} = 10$
15. $25^{(1/2)} = 5$
16. $2401^{(1/4)} = 7$
17. $81^{(5/4)} = 243$
18. $512^{(4/3)} = 4096$
19. $100^{(3/2)} = 1000$
20. $1296^{(5/4)} = 7776$
21. $625^{(3/4)} = 125$
22. $125^{(1/3)} = 5$
23. $1296^{(1/4)} = 6$
24. $4096^{(1/4)} = 8$
25. $25^{(5/2)} = 3125$
26. $64^{(3/2)} = 512$
27. $625^{(1/4)} = 5$
28. $64^{(1/2)} = 8$

Solutions (1 of 2)

Simplifying Radicals

Simplifying radicals

1. $\sqrt{63}$

$$\sqrt{63} = 3\sqrt{7}$$

Split 63 into a perfect square times whatever is left: $63 = 9 \times 7$. 9 is 3 squared, and 7 has no square factor of its own — that last part is what makes this the LARGEST perfect square inside, and it is where the answer stops.

A root splits across a product, so the one root becomes two.

$\sqrt{9}$ is 3, so it comes out in front. $\sqrt{7}$ stays under the sign, because 7 has nothing more to give.

2. $\sqrt{126}$

$$\sqrt{126} = 3\sqrt{14}$$

Split 126 into a perfect square times whatever is left: $126 = 9 \times 14$. 9 is 3 squared, and 14 has no square factor of its own — that last part is what makes this the LARGEST perfect square inside, and it is where the answer stops.

A root splits across a product, so the one root becomes two.

$\sqrt{9}$ is 3, so it comes out in front. $\sqrt{14}$ stays under the sign, because 14 has nothing more to give.

Rational Exponents

Rational exponents

1. $216^{2/3} = \underline{\hspace{2cm}}$

$$216^{2/3} = 36$$

The BOTTOM of the exponent says which root to take, so the cube root of 216 comes first. Root before power, always — the other order works and makes the numbers enormous.

The TOP says what to raise it to. 6 to the power 2 is 36. So $216^{2/3}$ is 36.

Solutions (2 of 2)

Rational Exponents (continued)

Rational exponents (continued)

2. $4^{3/2} = \underline{\hspace{2cm}}$

$$4^{(3/2)} = 8$$

The BOTTOM of the exponent says which root to take, so the square root of 4 comes first. Root before power, always — the other order works and makes the numbers enormous.

The TOP says what to raise it to. 2 to the power 3 is 8.
So $4^{(3/2)}$ is 8.