

Simplifying Radical Expressions

Steps to Simplify

1. Perfect Squares
2. Pull out Perfect Squares
3. Leave what is left under the radical

$$\sqrt{\#}$$

$$\sqrt{\text{variable}}$$

$$\sqrt{\# \text{ variable}}$$

Number	Squared	Square Root
1	1 1.1	$\sqrt{1} = 1$
2	4 2.2	$\sqrt{4} = 2$
3	9 3.3	$\sqrt{9} = 3$
4	16 4.4	$\sqrt{16} = 4$
5	25 5.5	$\sqrt{25} = 5$
6	36	$\sqrt{36} = 6$
7	49	$\sqrt{49} = 7$
8	64	$\sqrt{64} = 8$
9	81	$\sqrt{81} = 9$
10	100	$\sqrt{100} = 10$
11	121	$\sqrt{121} = 11$
12	144	$\sqrt{144} = 12$
13	169	$\sqrt{169} = 13$
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.		

Simply Radicals

$$\sqrt{20}$$

^ FACTOR 20

$$\sqrt{4 \cdot 5}$$

↑
Perfect Square

$$\sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5}$$

$2\sqrt{5}$

$$\sqrt{75}$$

$$\sqrt{25 \cdot 3}$$

$$\sqrt{25} \cdot \sqrt{3}$$

$$5\sqrt{3}$$

$$\sqrt{18}$$

$$\sqrt{9 \cdot 2}$$

$$\sqrt{9} \cdot \sqrt{2}$$

$$3\sqrt{2}$$

$$\sqrt{3 \cdot 3 \cdot 2}$$

→ $3\sqrt{2}$

$\sqrt{32}$ \wedge $\sqrt{16 \cdot 2}$ $\sqrt{16} \sqrt{2}$ $4\sqrt{2}$ <hr/> $2\sqrt{8 \cdot 4}$ $2\sqrt{8}$ $2 \cdot 2 \sqrt{4 \cdot 2}$ $4\sqrt{2}$	$\sqrt{72}$ $\sqrt{36} \sqrt{2}$ $6\sqrt{2}$ <hr/> $\sqrt{72}$ $2\sqrt{4 \cdot 18}$ $2\sqrt{18}$ $3 \cdot 2\sqrt{9 \cdot 2}$ $6\sqrt{2}$	$\sqrt{24}$ $\sqrt{24}$ $2\sqrt{4 \cdot 6}$ $2\sqrt{6}$
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$$\sqrt{363}$$

$$\sqrt{98}$$

$$\sqrt{75}$$

$$\sqrt{162}$$

Square Root of Variables

$$\sqrt{x}$$

$$\sqrt{3^2} = 3$$

"square root"

$$\sqrt{9} = \sqrt{3 \cdot 3} = 3$$

"number squared"

$$\sqrt{x^2} = \sqrt{x \cdot x} = x$$

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

$$\sqrt{x^2 \cdot x}$$

$$\sqrt{x^2} \cdot \sqrt{x}$$

$$x \cdot \sqrt{x}$$

$$x\sqrt{x}$$

$\frac{\sqrt{x^2}}{\sqrt{x \cdot x}}$ $= x$	$\frac{\sqrt{x^3}}{\sqrt{\cancel{x} \cdot \cancel{x} \cdot x}}$ $= x \sqrt{x}$	$\frac{\sqrt{x^4}}{\sqrt{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x}}}$ $\sqrt{\cancel{x^2} \cdot \cancel{x^2}}$ $x \cdot x = x^2$	$\frac{\sqrt{x^5}}{\sqrt{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot x}}$ $\sqrt{\cancel{x^2} \cdot \cancel{x^2} \cdot x}$ $x \cdot x \cdot \sqrt{x}$ $= x^2 \sqrt{x}$	$\frac{\sqrt{x^6}}{\sqrt{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x}}}$ $\sqrt{\cancel{x^2} \cdot \cancel{x^2} \cdot \cancel{x^2}}$ $\sqrt{\cancel{x^2} \cdot \cancel{x^2} \cdot \cancel{x^2}}$ $x \cdot x \cdot x$ $= x^3$
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Conclusion:

<p>even degree come out of square root</p>	<p>odd degree • Factor out square • $\sqrt{x} = \sqrt{x}$</p>
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Cheat Sheet

$$\sqrt{x^{48}} \rightarrow \frac{48}{2} = 24$$

$$= x^{24}$$

$$\sqrt{x^{77}} \rightarrow \frac{77}{2} = 38.5$$

$$x^{38} \sqrt{x}$$

$\sqrt{27x^{11}}$ $\sqrt{27} \cdot \sqrt{x^{11}}$ $\sqrt{9 \cdot 3} \cdot x^5 \sqrt{x}$ $3\sqrt{3}$ $3\sqrt{3} \cdot x^5 \sqrt{x}$ $3x^5 \sqrt{3} \cdot \sqrt{x}$ $3x^5 \sqrt{3x}$ <p style="text-align: right;">$\frac{11}{2} = 5.5$</p>	$\sqrt{24x^{16}}$ $\sqrt{4 \cdot 6} \cdot x^8$ $2\sqrt{6} \cdot x^8$ $2x^8 \sqrt{6}$ <p style="text-align: right;">$16/2 = 8$</p>	$\sqrt{48x^3}$ $\sqrt{16 \cdot 3} \cdot \sqrt{x^3 \cdot x}$ $4\sqrt{3} \cdot \sqrt{x^3 \cdot x}$ $4x \sqrt{3x}$
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Simplify.

1) $\sqrt{125n}$

2) $\sqrt{216v}$

3) $\sqrt{512k^2}$

4) $\sqrt{512m^3}$

5) $\sqrt{216k^4}$

6) $\sqrt{100v^3}$

7) $\sqrt{80p^3}$

8) $\sqrt{45p^2}$

9) $\sqrt{147m^3n^3}$

10) $\sqrt{200m^4n}$

11) $\sqrt{75x^2y}$

12) $\sqrt{64m^3n^3}$

15) $\sqrt{36x^2y^3}$

16) $\sqrt{384x^4y^3}$

17) $7\sqrt{96m^3}$

18) $6\sqrt{72x^2}$

19) $-6\sqrt{150r}$

20) $5\sqrt{80a^2}$

21) $2\sqrt{125v}$

22) $-8\sqrt{24k^3}$

23) $-4\sqrt{192x}$

24) $2\sqrt{8p^2q^3r}$

25) $-4\sqrt{216x^2y^2z}$

26) $-3\sqrt{24a^4b^2c^3}$

27) $3\sqrt{16x^4y^4z}$

28) $-2\sqrt{48a^3b^4c^2}$

29) $6\sqrt{75mp^2q^3}$

30) $4\sqrt{36x^2y^3z^4}$