Simplifying Radicals

A perfect square is the product of a number multiplied by itself.

Ex) 81 is a perfect square since 81 = (9)(9)

Square root	Perfect square	Square root	Perfect square
2	4	9	81
3	9	10	100
4	16	11	121
5	25	12	144
6	36	13	169
7	49	14	196
8	64	15	225

Definitions

$\sqrt[n]{x}$

index → n

radical → $\sqrt{}$

radicand → x

Ex: $\sqrt[3]{8}$

3 → index

8 → radicand

A radical is simplified when the radicand has no perfect square factors.

Ex 1) $\sqrt{33}$ cannot be simplified

To put a radical in its simpliest form we use the Radical Mulitplication Property

$$\boxed{\underset{33}{\sqrt{ab}} = \underset{3}{\sqrt{a}} \cdot \underset{11}{\sqrt{b}} \quad \text{if } a \geq 0,\ b \geq 0}$$

Ex 2) $\sqrt{18} = \sqrt{9 \cdot 2} = \sqrt{9} \cdot \sqrt{2} = 3\sqrt{2}$

An expression of the form $\sqrt{x}$ is called an entire radical.

An expression of the form $a\sqrt{x}$ is called a mixed radical.

Mixed radicals, such as $3\sqrt{2}$ means $3 \times \sqrt{2}$ just as 3n means 3 x n or (3)(n)

Ex 3) Simplify the following:

$\sqrt{1} = 1$

$\sqrt{2}$ ×

$\sqrt{3}$ ×

$\sqrt{4} = 2$

$\sqrt{5}$ ×

$\sqrt{6}$ ×

$\sqrt{7}$ ×

$\sqrt{8}$ $\sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$

$\sqrt{9} = 3$

$\sqrt{10}$ ×

$\sqrt{11}$ ×

$\sqrt{12}$ $\sqrt{4}\sqrt{3} = 2\sqrt{3}$

$\sqrt{13}$ ×

$\sqrt{14}$ ×

$\sqrt{15}$ ×

$\sqrt{16} = 4$

$\sqrt{17}$ ×

$\sqrt{18}$ $\sqrt{9}\sqrt{2} = 3\sqrt{2}$

$\sqrt{19}$ ×

$\sqrt{20}$ $\sqrt{4}\sqrt{5} = 2\sqrt{5}$

$\sqrt{21}$ ×

$\sqrt{22}$ ×

$\sqrt{23}$ ×

$\sqrt{24}$ $\sqrt{4}\sqrt{6} = 2\sqrt{6}$

$\sqrt{25} = 5$

$\sqrt{26}$ ×

$\sqrt{27} = \sqrt{9}\sqrt{3} = 3\sqrt{3}$

$\sqrt{28} = \sqrt{4}\sqrt{7} = 2\sqrt{7}$

$\sqrt{29}$ ×

$\sqrt{30}$ ×

$\sqrt{500}$ $\sqrt{100}\sqrt{5}$
$10\sqrt{5}$

$\sqrt{125}$ $\sqrt{25}\sqrt{5}$
$5\sqrt{5}$

$\sqrt{96}$ $\sqrt{16}\sqrt{6}$
$4\sqrt{6}$

$\sqrt{45}$ $\sqrt{9}\sqrt{5}$
$3\sqrt{5}$

$\sqrt{60}$ $\sqrt{4}\sqrt{15}$
$2\sqrt{15}$

$\sqrt{117}$ $\sqrt{9}\sqrt{13}$
$3\sqrt{13}$

$\sqrt{200}$ $\sqrt{4}\sqrt{50}$
$2\sqrt{50}$
$2\sqrt{25}\sqrt{2}$
$2 \cdot 5 \cdot \sqrt{2}$
$10\sqrt{2}$

$\sqrt{100}\sqrt{2}$
$10\sqrt{2}$
largest square

$\sqrt{72}$ $\sqrt{36}\sqrt{2}$
$6\sqrt{2}$

$\sqrt{48}$ $\sqrt{16}\sqrt{3}$
$4\sqrt{3}$

$\sqrt{32}$ $\sqrt{16}\sqrt{2}$
$4\sqrt{2}$

$\sqrt{27}$ $\sqrt{9}\sqrt{3}$
$3\sqrt{3}$

$\sqrt{40}$ $\sqrt{4}\sqrt{10}$
$2\sqrt{10}$

$\sqrt{80}$ $\sqrt{16}\sqrt{5}$
$4\sqrt{5}$