6.1 Radicals

Obj: To simplify a radical with different index. (with and without variables.)

Make a note card with perfect powers. Squares, cubes, fourths, & fifths

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Perfect Powers:

•**Squares**

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, …

1 2 3 4 5 6 7 8 9 10 11 12 13

•**Cubes**

1, 8, 27, 64, 125, 216, 343, …

1 2 3 4 5 6 7

•**Fourths**

1, 16, 81, 256, 625, 1296, …

1 2 3 4 5 6

•**Fifths**

1, 32, 243, 1024, 3125, …

1 2 3 4 5

Notes:

- Radical
- Index
- Radicand
- Don't forget the index!!!
- If there is no index.....
- Write the index clearly!!!

Examples of square roots, cube roots, fourth roots…

$\sqrt{25}$ $\sqrt[3]{125}$ $\sqrt[3]{8}$ $\sqrt[3]{-8}$ $\sqrt[3]{1000}$

5 5 2 -2 10

$\sqrt[4]{16}$ $\sqrt[4]{81}$ $\sqrt[5]{32}$ $\sqrt[5]{243}$ $\sqrt[5]{-243}$

2 3 2 3 -3

Examples (not perfect powers)

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

$\sqrt[3]{250}$ $(125 \cdot 2)$ $5\sqrt[3]{2}$

$\sqrt[3]{40}$ $2\sqrt[3]{5}$

$\sqrt[3]{-54}$ $-3\sqrt[3]{2}$

$\sqrt[3]{5000}$ $(1{,}000 \cdot 5)$ $10\sqrt[3]{5}$

$\sqrt[4]{32}$ $2\sqrt[4]{2}$

$\sqrt[4]{162}$ $(81 \cdot 2)$ $3\sqrt[4]{2}$

$\sqrt[5]{64}$ $2\sqrt[5]{2}$

$2\sqrt[5]{243}$ $2 \cdot 3$ 6

$5\sqrt[3]{-32}$ $5 \cdot -2\sqrt[3]{2}$ $-10\sqrt[3]{2}$

Variables:

$\sqrt{x^2}$ x

$\sqrt{x^{10}}$ x^5

$\sqrt[3]{x^{12}}$ $x^{12 \div 3}$ x^4

$\sqrt[3]{x^{21}}$ $x^{21 \div 3}$ x^7

$\sqrt[4]{t^{64}}$ $t^{64 \div 4}$ t^{16}

$\sqrt[5]{w^{30}}$ $w^{30 \div 5}$ w^6

$\sqrt{w^9}$ $w^{9 \div 2}$ $w^4\sqrt{w^1}$

$\sqrt[5]{y^{13}}$ $y^{13 \div 5}$ $y^2\sqrt[5]{y^3}$

$\sqrt[3]{x^{18}y^{11}w^{22}}$ $x^{18 \div 3}y^{11 \div 3}w^{22 \div 3}$ $x^6y^3w^7\sqrt[3]{y^2w^1}$

remainder after dividing

More Examples:

$5x^5\sqrt{9x^6w^{13}}$

$5x5 \cdot 3x^3w^6\sqrt{w}$

$15x^8w^6\sqrt{w}$

$10\sqrt[3]{-27x^{14}y^6}$

$-30x^4y^2\sqrt[3]{x^2}$

$5\sqrt[3]{4x^2w^3} \cdot 2\sqrt[3]{6x^4w^{12}y}$

$5\sqrt[3]{40} - 6\sqrt[3]{5}$

$5 \cdot 2\sqrt[3]{5} - 6\sqrt[3]{5}$

$10\sqrt[3]{5} - 6\sqrt[3]{5}$

$4\sqrt[3]{5}$

More Examples:

$\left(\sqrt{5x}\right)^2$

$5x$

$\left(\sqrt[3]{17w}\right)^3$

$17w$

$\left(2\sqrt[3]{5t^2}\right)^3$

$8 \cdot 5t^2$

$40t^2$