480/81
Day 1
Notes

8.3 SIMPLIFYING RADICALS

OBJECTIVE:

- Add, subtract, multiply, divide and rationalize radical expressions.

You are already used to simplifying square roots. Now, we are going to increase the difficulty by asking you to simplify an n^{th} root.

Simplify:

1, 4, 9, 16, 25, 36, ...

1. $\sqrt{48}$

$\sqrt{16}\sqrt{3}$

$\boxed{4\sqrt{3}}$

$1, 2^3, 3^3, 4^3, 5^3, 6^3, \ldots$

$1, 8, 27, 64, 125, 216, \ldots$

2. $\sqrt[3]{72}$

$\sqrt[3]{8}\sqrt[3]{9}$

$\boxed{2\sqrt[3]{9}}$

3. $4\sqrt{125} - 8\sqrt{20} + 2\sqrt{180}$

$4 \cdot \sqrt{25}\sqrt{5} - 8\sqrt{4}\sqrt{5} + 2\sqrt{36}\sqrt{5}$

$4 \cdot 5\sqrt{5} - 8 \cdot 2\sqrt{5} + 2 \cdot 6\sqrt{5}$

$20\sqrt{5} - 16\sqrt{5} + 12\sqrt{5}$

$\boxed{16\sqrt{5}}$

4. $2\sqrt[3]{48} - \sqrt[3]{384} + 3\sqrt[3]{750}$

$2\sqrt[3]{8}\sqrt[3]{6} - \sqrt[3]{64}\sqrt[3]{6} + 3\sqrt[3]{125}\sqrt[3]{6}$

$2 \cdot 2\sqrt[3]{6} - 4\sqrt[3]{6} + 3 \cdot 5\sqrt[3]{6}$

$4\sqrt[3]{6} - 4\sqrt[3]{6} + 15\sqrt[3]{6}$

$\boxed{15\sqrt[3]{6}}$

RATIONALIZING THE DENOMINATOR:

5. $\sqrt{\frac{16}{5}}$

$\frac{\sqrt{16}}{\sqrt{5}} = \frac{4}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \boxed{\frac{4\sqrt{5}}{5}}$

6. $\frac{4}{\sqrt[3]{5}}$

$\frac{4}{\sqrt[3]{5}} \cdot \frac{\sqrt[3]{5}}{\sqrt[3]{5}}$ no!

$\frac{4}{\sqrt[3]{5}} \cdot \frac{\sqrt[3]{5^2}}{\sqrt[3]{5^2}} = \frac{4\sqrt[3]{5^2}}{\sqrt[3]{5^3}}$

$= \boxed{\frac{4\sqrt[3]{25}}{5}}$

BIGGER PICTURE:

Why does $\sqrt{36} = 6$?

INVERSES!

$\sqrt{36} = \sqrt[2]{6^2} = \sqrt[1]{6^1} = 6$

So, if $\sqrt[3]{27} = \sqrt[3]{3^3} = 3$, then

$$\sqrt[x]{y^x} = y$$

7. $\frac{1}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{2^2}}{\sqrt[3]{2^2}} = \boxed{\frac{\sqrt[3]{4}}{2}}$

8. $\frac{1}{\sqrt[5]{4}} = \frac{1}{\sqrt[5]{2^2}} \cdot \frac{\sqrt[5]{2^3}}{\sqrt[5]{2^3}} = \boxed{\frac{\sqrt[5]{8}}{2}}$

9. $\dfrac{4}{\sqrt{7}+\sqrt{3}}$

$\dfrac{\sqrt{7}-\sqrt{3}}{\sqrt{7}-\sqrt{3}} = \dfrac{4\sqrt{7}-4\sqrt{3}}{7-3} = \dfrac{4\sqrt{7}-4\sqrt{3}}{4}$

$= \boxed{\sqrt{7}-\sqrt{3}}$

RECALL THESE BASIC PATTERNS:

$$(x-y)^2 = x^2 - 2xy + y^2$$
$$(x+y)^2 = x^2 + 2xy + y^2$$
$$(x+y)(x-y) = x^2 - y^2$$

10. $\dfrac{3}{2\sqrt{6}} - \dfrac{3\sqrt{6}}{6}$

$\dfrac{3}{2\sqrt{6}} \cdot \dfrac{\sqrt{6}}{\sqrt{6}} - \dfrac{3\sqrt{6}}{6} =$

$\dfrac{3\sqrt{6}}{12} - \dfrac{3\sqrt{6}}{6} =$

$\dfrac{3\sqrt{6}}{12} - \dfrac{6\sqrt{6}}{12} = \dfrac{-3\sqrt{6}}{12} = \boxed{\dfrac{-\sqrt{6}}{4}}$

11. $\dfrac{6}{\sqrt[4]{9}} + 2\sqrt[4]{3}$

$\dfrac{6}{\sqrt[4]{3^2}} + 2\sqrt[4]{3}$

$\dfrac{6}{\sqrt{3}} + 2\sqrt[4]{3}$

$\dfrac{6}{\sqrt{3}} \cdot \dfrac{\sqrt{3}}{\sqrt{3}} + 2\sqrt[4]{3}$

$\dfrac{6\sqrt{3}}{3} + 2\sqrt[4]{3}$

$\boxed{2\sqrt{3} + 2\sqrt[4]{3}}$

COMMON ERRORS!

1) $\dfrac{4}{7+\sqrt{2}} = \dfrac{4}{7+\sqrt{2}} \cdot \dfrac{\sqrt{2}}{\sqrt{2}}$

$= \dfrac{4\sqrt{2}}{7+2} = \dfrac{4\sqrt{2}}{9}$

2) $\dfrac{4}{\sqrt[3]{3}} = \dfrac{4}{\sqrt[3]{3}} \cdot \dfrac{\sqrt[3]{3}}{\sqrt[3]{3}}$

$= \dfrac{4\sqrt[3]{3}}{3}$

1) $\dfrac{4}{7+\sqrt{2}} \cdot \dfrac{7-\sqrt{2}}{7-\sqrt{2}} = \dfrac{28-4\sqrt{2}}{49-2}$

$= \boxed{\dfrac{28-4\sqrt{2}}{47}}$

2) $\dfrac{4}{\sqrt[3]{3}} \cdot \dfrac{\sqrt[3]{3^2}}{\sqrt[3]{3^2}} = \boxed{\dfrac{4\sqrt[3]{9}}{3}}$