Do Now: Simplify

$a^2 \cdot a^3$ a^5

$(xy^3)(x^2y)$ x^3y^4

$(ab^2)^3$ a^3b^6

$\frac{m^6}{m^2}$ m^4

$\frac{n^3}{n^5}$ $\frac{1}{n^2}$ or n^{-2}

$\left(\frac{x^3}{y^4}\right)^{-2}$ $\frac{x^{-6}}{y^{-8}} = \frac{y^8}{x^6}$

Fractional exponents

- $b^{1/2} = \sqrt{b}$ Proof: $\left(b^{1/2}\right)^2 = b^{2\cdot\frac{1}{2}} = b^1 = b$ and $\left(\sqrt{b}\right)^2 = b$, therefore $b^{1/2} = \sqrt{b}$
- $b^{1/m} = \sqrt[m]{b}$ Proof: $\left(b^{1/m}\right)^m = b^{m\cdot\frac{1}{m}} = b^1 = b$ and $\left(\sqrt[m]{b}\right)^m = b$, therefore $b^{1/m} = \sqrt[m]{b}$
- $b^{2/3} = \sqrt[3]{b^2}$ or $= \left(\sqrt[3]{b}\right)^2$ Proof: $\left(b^{1/3}\right)^2 = \left(\sqrt[3]{b}\right)^2$; $\left(b^2\right)^{1/3} = \sqrt[3]{b^2}$ and $\left(\sqrt[3]{b}\right)^3 = b$
- $b^{n/m} = \left(\sqrt[m]{b}\right)^n = \sqrt[m]{b^n}$

Ex. 1: Simplify $16^{3/4}$.

Method 1: $16^{3/4} = (16^{1/4})^3 = \left(\sqrt[4]{16}\right)^3 = 2^3 = 8$

Method 2: $16^{3/4} = (16^3)^{1/4} = \sqrt[4]{16^3} = \sqrt[4]{4096} = 8$

You do: Simplify

$81^{3/2}$

$(\sqrt{81})^3$

$9^3 = 729$

$8^{5/3}$

$(\sqrt[3]{8})^5$

$2^5 = 32$

Ex. 2: Simplify

$25^{-3/2}$

$\frac{1}{25^{3/2}}$

$\frac{1}{(\sqrt{25})^3} = \frac{1}{5^3} = \frac{1}{125}$

$9^{2.5}$

$9^{5/2}$

$(\sqrt{9})^5$

$3^5 = 243$

You do: Simplify

$49^{-1/2}$

$\frac{1}{49^{1/2}}$

$\frac{1}{\sqrt{49}} = \frac{1}{7}$

$8^{-5/3}$

$\frac{1}{8^{5/3}}$

$\frac{1}{(\sqrt[3]{8})^5}$

$\frac{1}{2^5} = \frac{1}{32}$

$16^{2.5}$

$16^{5/2}$

$(\sqrt{16})^5$

4^5

1024

Ex. 3: Write in exponential form.

$\sqrt[3]{\frac{a^5b^3}{c^2}}$

$(a^5b^3c^{-2})^{\frac{1}{3}}$

$a^{5/3}b^1c^{-2/3}$

$\left(\frac{1}{\sqrt[3]{4}}\right)^{-3/2}$

$\left(\frac{1}{4^{1/3}}\right)^{-3/2}$

$(4^{-1/3})^{-3/2}$

$4^{1/2}$

$\sqrt{4}$

2

You do:

$\left(\frac{1}{\sqrt[3]{81}}\right)^{-3/4}$

$\left(\frac{1}{81^{1/3}}\right)^{-3/4}$

$(81^{-1/3})^{-3/4}$

$81^{1/4}$

$(3^4)^{1/4}$

3

$\sqrt{ab^3}$

$a^{\frac{1}{2}}b^{\frac{3}{2}}$

$\frac{1}{\sqrt[3]{xy^5}}$

$(xy^5)^{-1/3}$

$x^{-1/3}y^{-5/3}$

Ex. 4: Express in simplified exponential and simplest radical form.

$\sqrt{8}\cdot\sqrt[3]{4}$ base 2

$(2^3)^{\frac{1}{2}}\cdot(2^2)^{\frac{1}{3}}$

$2^{\frac{3}{2}}\cdot 2^{\frac{2}{3}} = 2^{\frac{9}{6}+\frac{4}{6}}$

$2^{13/6}$

$\sqrt[6]{2^{13}} = \sqrt[6]{2^{12}\cdot 2}$

$= 4\cdot\sqrt[6]{2}$

SAME BASE!

$\sqrt[3]{9}\cdot\sqrt{3}$ base 3

$(3^2)^{\frac{1}{3}}(3)^{\frac{1}{2}}$

$3^{2/3}\cdot 3^{1/2} = 3^{\frac{4}{6}+\frac{3}{6}}$

$3^{7/6}$

$\sqrt[6]{3^6\cdot 3} = 3\cdot\sqrt[6]{3}$

You do:

$\sqrt[3]{16}\cdot\sqrt{8}$ base 2

$(2^4)^{\frac{1}{3}}\cdot(2^3)^{\frac{1}{2}}$

$2^{4/3}\cdot 2^{3/2} = 2^{\frac{8}{6}+\frac{9}{6}}$

$2^{17/6}$

$\sqrt[6]{2^6\cdot 2^6\cdot 2^5}$

$4\cdot\sqrt[6]{2^5}$

$\sqrt[6]{5^5}\div\sqrt[3]{25}$ base 5

$5^{5/6}\cdot(5^2)^{-1/3}$

$5^{5/6}\cdot 5^{-2/3} = 5^{\frac{5}{6}-\frac{4}{6}}$

$5^{1/6}$

$\sqrt[6]{5}$

Ex. 5: Express in simplified exponential form.

$\sqrt[3]{a^2}\cdot\sqrt[3]{a^4}$

$a^{2/3}\cdot a^{4/3}$

$a^{\frac{2}{3}+\frac{4}{3}}$

$a^{\frac{6}{3}}$

a^2

OR

$\sqrt[3]{a^6} = a^2$

$((b^{1/2})^{-2/3})^{3/4}$

$\frac{1}{2}\cdot\frac{-2}{3}\cdot\frac{3}{4} = -\frac{1}{4}$

$b^{-1/4}$

You do:

$\frac{\sqrt[5]{27^3}}{\sqrt[5]{9^2}}$

$\frac{\sqrt[5]{(3^3)^3}}{\sqrt[5]{(3^2)^2}}$

$\sqrt[5]{\frac{3^9}{3^4}}$

$\sqrt[5]{3^5}$

3

$\frac{x^{3/2}-2x^{5/2}}{x^{1/2}}$

$\frac{x^{3/2}}{x^{1/2}} - \frac{2x^{5/2}}{x^{1/2}}$

$x^{2/2} - 2x^{4/2}$

$x - 2x^2$