

What's Going On?

Checking In

Minds on

Applying the Basics

Action!

Simplifying Exponential Expressions

Consolidation

Big Question

Learning Goal - I will be able to simplify algebraic expressions involving powers and radicals.

Big Questions!

(From Yesterday)

Evaluate.

$$81^{\frac{1}{2}} - 8^{\frac{1}{3}} - 32^{\frac{4}{5}} + 16^{\frac{3}{4}} + 1^{\frac{2}{9}}$$

*Start by rewriting as radicals.

$$= \sqrt{81} - \sqrt[3]{8} - \sqrt[5]{32}^4 + \sqrt[4]{16}^3 + \sqrt[9]{1}^2$$

$$= 9 - 2 - (2)^4 + (2)^3 + (1)^2$$

$$= 9 - 2 - 16 + 8 + 1$$

$$= 7 - 16 + 8 + 1$$

$$= -9 + 8 + 1$$

$$= 0$$

Simplify, then evaluate.

$$\frac{\left(8^{\frac{4}{3}}\right)^{\frac{1}{2}}}{8^{\frac{7}{6}}\sqrt{8}}$$

$\frac{4}{3} \times \frac{1}{2} = \frac{4}{6}$

* rewrite with rational exponents

$$= \frac{8^{\frac{4}{6}}}{8^{\frac{7}{6}} \cdot 8^{\frac{1}{2}}}$$

* add the exponents!

$$= \frac{8^{\frac{4}{6}}}{8^{\frac{7}{6} + \frac{3}{6}}} = \frac{8^{\frac{4}{6}}}{8^{\frac{10}{6}}} = 8^{\frac{4}{6} - \frac{10}{6}}$$

$$= 8^{-\frac{6}{6}} = 8^{-1} = \frac{1}{8}$$

Minds on

Applying the Basics

Simplify. Express each answer with positive exponents.

$$a^6(a^4) = a^{\boxed{6+4}} = a^{\boxed{10}}$$

$$\frac{b^4}{b^{-2}} = b^{\boxed{4 - -2}} = b^{\boxed{6}}$$

$$(c^4)^3 = c^{\boxed{4 \times 3}} = c^{\boxed{12}}$$

$$(d^{-4})(d^7) = d^{\boxed{-4+7}}$$
$$= d^{\boxed{3}}$$

$$\frac{e^{-5}}{e^{-3}} = e^{\boxed{-5 - -3}}$$
$$= e^{\boxed{-2}}$$
$$= \frac{1}{e^2}$$

$$\begin{aligned}(f^7)^{-2} &= f^{\boxed{7 \times -2}} \\ &= f^{\boxed{-14}} \\ &= \frac{1}{f^{14}}\end{aligned}$$

Action!

Simplifying Exponential Expressions

We can simplify algebraic expressions involving powers in the same way that we simplify numerical expressions...

Use the Exponent Laws

Action!

Simplifying Exponential Expressions

$$\text{Simplify } \frac{(2x^{-3}y^2)^3}{(x^3y^{-4})^2}$$

$$= \frac{2^3 x^{(-3)(3)} y^{(2)(3)}}{x^{(3)(2)} y^{(-4)(2)}}$$

$$= \frac{8 \cdot x^{-9} \cdot y^6}{x^6 \cdot y^{-8}}$$

$$= 8x^{-9-6} y^{6-(-8)}$$

$$= 8x^{-15} y^{14}$$

$$= \frac{8y^{14}}{x^{15}}$$

* Distribute the exponents outside the brackets into the brackets.

$$\frac{(2x^{-3}y^2)(2x^{-3}y^2)(2x^{-3}y^2)}{(x^3y^{-4})(x^3y^{-4})}$$

$$\frac{8 \cdot y^6 \cdot y^8}{x^6 \cdot x^9} = \frac{8y^{14}}{x^{15}}$$

Action!

Simplifying Exponential Expressions

Evaluate the expression $\frac{(x^{2n+1})(x^{3n-1})}{x^{2n-5}}$

for $x = -3$ and $n = 2$ by

Simplifying, then substituting.

$$\frac{(x^{2n+1})(x^{3n-1})}{x^{2n-5}} = x^{(2n+1)+(3n-1)-(2n-5)}$$

$$= \frac{x^{(2n+1)+(3n-1)}}{x^{2n-5}} = x^{3n+5}$$

$$= \frac{x^{2n+1+3n-1}}{x^{2n-5}}$$

$$= \frac{x^{5n}}{x^{2n-5}}$$

$$= x^{5n-(2n-5)}$$

$$= x^{5n-2n+5}$$

$$= x^{3n+5}$$

When $x = -3$ and $n = 2$

$$= (-3)^{3(2)+5}$$

$$= (-3)^{11}$$

Action!

Simplifying Exponential Expressions

Evaluate the expression $\frac{(x^{2n+1})(x^{3n-1})}{x^{2n-5}}$

for $x = -3$ and $n = 2$ by

Substituting, then simplifying.

$$\frac{(x^{2n+1})(x^{3n-1})}{(x^{2n-5})}$$

$$= \frac{((-3)^{2(2)+1})((-3)^{3(2)-1})}{(-3)^{2(2)-5}}$$

$$= \frac{((-3)^5)((-3)^5)}{(-3)^{-1}}$$

$$= (-3)^{5+5-(-1)}$$

$$= (-3)^{11}$$

Action!

Simplifying Exponential Expressions

Which method did you prefer?

Consolidation

Big Questions!

$$\frac{(27a^{-3}b^{12})^{\frac{1}{3}}}{(16a^{-8}b^{12})^{\frac{1}{2}}}$$

$$= \frac{27^{\frac{1}{3}} a^{(-3)(\frac{1}{3})} b^{(12)(\frac{1}{3})}}{16^{\frac{1}{2}} a^{(-8)(\frac{1}{2})} b^{(12)(\frac{1}{2})}}$$

$$= \frac{\sqrt[3]{27} a^{-\frac{3}{3}} b^{\frac{12}{3}}}{\sqrt{16} a^{-\frac{8}{2}} b^{\frac{12}{2}}}$$

$$= \frac{3a^{-1}b^4}{4a^{-4}b^6}$$

$$= \frac{3}{4} a^{-1-(-4)} b^{4-6}$$

$$= \frac{3}{4} a^3 b^{-2}$$

$$= \frac{3a^3}{4b^2}$$

Consolidation

Big Questions!

$$\frac{-3}{1} \times \frac{1}{3} = -1$$

$$12 \times \frac{1}{3} = 4$$

$$\frac{(27a^{-3}b^{12})^{\frac{1}{3}}}{(16a^{-8}b^{12})^{\frac{1}{2}}}$$

$$= \frac{\sqrt[3]{27} a^{-1} b^4}{\sqrt{16} a^{-4} b^6}$$

$$= \frac{3 a^{-1-4} b^{4-6}}{4}$$

$$= \frac{3 a^3 b^{-2}}{4}$$

$$= \frac{3a^3}{4b^2}$$

$$\left(\frac{\sqrt[5]{x^8}}{\sqrt[2]{x^3}} \right)^3$$

$$= \left(\frac{x^{\frac{8}{5}}}{x^{\frac{3}{2}}} \right)^3 \quad \text{OR}$$

$$\frac{x^{\frac{24}{5}}}{x^{\frac{9}{2}}}$$

$$= x^{\frac{24}{5} - \frac{9}{2}}$$

$$= x^{\frac{48}{10} - \frac{45}{10}}$$

$$= x^{\frac{3}{10}}$$

$$= \sqrt[10]{x^3}$$

$$= \left(x^{\frac{8}{5} - \frac{3}{2}} \right)^3$$

$$= \left(x^{\frac{16}{10} - \frac{15}{10}} \right)^3$$

$$= \left(x^{\frac{1}{10}} \right)^3$$

$$= x^{\frac{3}{10}} \quad \text{- exponent form}$$

$$= \sqrt[10]{x^3} \quad \text{- radical form}$$