4.6 Applying the Exponent Laws

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RECALL EXPONENT LAWS

$a^m \cdot a^n = a^{m+n}$

$a^m \div a^n = a^{m-n} \quad a \neq 0$

$(a^n)^n = a^{m \times n}$

$(ab)^m = a^m \cdot b^m$

$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, \quad b \neq 0$

→ We can use the exponent laws to simplify expressions
→ Write a simplified power with a positive exponent

Ex #1

Simplify by writing as a single power with positive exponents only!

(a.) $0.8^2 \cdot 0.8^{-7}$

$= 0.8^{2+(-7)}$

$= 0.8^{-5}$

$= \boxed{\frac{1}{0.8^5}}$

(b.) $\left[\left(-\frac{4}{5}\right)^2\right]^{-3} \div \left[\left(-\frac{4}{5}\right)^4\right]^{-5}$

$= \left(-\frac{4}{5}\right)^{2 \cdot -3} \div \left(-\frac{4}{5}\right)^{4 \cdot -5}$

$= \left(-\frac{4}{5}\right)^{-6} \div \left(-\frac{4}{5}\right)^{-20}$

$= \left(-\frac{4}{5}\right)^{(-6)-(-20)}$

$= \boxed{\left(-\frac{4}{5}\right)^{14}}$

(c.) $\frac{(1.5^{-3})^{-5}}{1.5^5}$

(d.) $\frac{9^{\frac{5}{4}} \cdot 9^{-\frac{1}{4}}}{9^3}$

(c.) $\dfrac{(1.5^{-3})^{-5}}{1.5^{5}}$

$= \dfrac{1.5^{-3\times -5}}{1.5^{5}}$

$= \dfrac{1.5^{15}}{1.5^{5}}$

$= 1.5^{15-5}$

$= \boxed{1.5^{10}}$

(d.) $\dfrac{9^{4}\cdot 9}{9^{\frac{3}{4}}}$

$= \dfrac{9^{\frac{5}{4}+\left(-\frac{1}{4}\right)}}{9^{\frac{3}{4}}}$

$= \dfrac{9^{\frac{5}{4}-\frac{1}{4}}}{9^{\frac{3}{4}}}$

$= \dfrac{9^{\frac{4}{4}}}{9^{\frac{3}{4}}}$

$= 9^{\frac{4}{4}-\frac{3}{4}} = \boxed{9^{\frac{1}{4}}}$

Simplifying Algebraic Expressions

Ex. #2

(a.) $(x^{3}y^{2})(x^{2}y^{-4})$

$= x^{3}\cdot x^{2}\cdot y^{2}\cdot y^{-4}$

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

$= x^{5}\cdot y^{-2}$

$= x^{5}\cdot \dfrac{1}{y^{2}} = \boxed{\dfrac{x^{5}}{y^{2}}}$

(b.) $\dfrac{10a^{5}b^{3}}{2a^{2}b^{-2}}$

$= \dfrac{10}{2}\cdot\dfrac{a^{5}}{a^{2}}\cdot\dfrac{b^{3}}{b^{-2}}$

$= 5\cdot a^{5-2}\cdot b^{3-(-2)}$

$= \boxed{5a^{3}b^{5}}$

Simplifying Algebraic Expressions with Rational Exponents

Ex. #3 Simplify (Positive exponents only!)

(a.) $(25a^{4}b^{2})^{\frac{3}{2}}$

(b.) $(x^{3}y^{-\frac{3}{2}})(x^{-1}y^{\frac{1}{2}})$

(a.) $(25a^4b^2)^{\frac{3}{2}}$

$= 25^{\frac{3}{2}} \cdot a^{4\cdot\frac{3}{2}} \cdot b^{2\cdot\frac{3}{2}}$

$= (\sqrt{25})^3 \cdot a^{\frac{12}{2}} \cdot b^{\frac{6}{2}}$

$= (5)^3 \cdot a^6 \cdot b^3$

$= \boxed{125a^6b^3}$

(b.) $(x^3y^{-\frac{3}{2}})(x^{-1}y^{\frac{1}{2}})$

$= x^3 \cdot x^{-1} \cdot y^{-\frac{3}{2}} \cdot y^{\frac{1}{2}}$

$= x^{3+(-1)} \cdot y^{-\frac{3}{2}+\frac{1}{2}}$

$= x^2 \cdot y^{-\frac{2}{2}}$

$= x^2 \cdot y^{-1} = \boxed{\frac{x^2}{y}}$

(c.) $\dfrac{12x^{-5}y^{\frac{5}{2}}}{3x^{\frac{1}{2}}y^{-\frac{1}{2}}}$

$= \frac{12}{3} \cdot \frac{x^{-5}}{x^{\frac{1}{2}}} \cdot \frac{y^{\frac{5}{2}}}{y^{-\frac{1}{2}}}$

$= 4 \cdot x^{-5-\frac{1}{2}} \cdot y^{\frac{5}{2}-(-\frac{1}{2})}$

$= 4x^{-\frac{10}{2}-\frac{1}{2}} \cdot y^{\frac{5}{2}+\frac{1}{2}}$

$= 4x^{-\frac{11}{2}} \cdot y^{\frac{6}{2}}$

$= 4 \cdot x^{-\frac{11}{2}} \cdot y^3 = \boxed{\frac{4y^3}{x^{\frac{11}{2}}}}$

(d.) $\left(\dfrac{50x^2y^4}{2x^4y^7}\right)^{\frac{1}{2}}$

$= \left(\frac{50}{2} \cdot \frac{x^2}{x^4} \cdot \frac{y^4}{y^7}\right)^{\frac{1}{2}}$

$= \left(25 \cdot x^{-2} \cdot y^{-3}\right)^{\frac{1}{2}}$

$= 25^{\frac{1}{2}} \cdot x^{-2(\frac{1}{2})} \cdot y^{-3(\frac{1}{2})}$

$= \sqrt{25} \cdot x^{-\frac{2}{2}} \cdot y^{-\frac{3}{2}}$

$= 5 \cdot x^{-1} \cdot y^{-\frac{3}{2}}$

$= \boxed{\frac{5}{x y^{\frac{3}{2}}}}$

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