You solutions may follow different paths than mine but still be correct.

Questions

1. Write down the rules of exponents.

2. Simplify $\left(\dfrac{3xy^{-2}}{y^3}\right)^{-2}$

3. Simplify $\left(\dfrac{5x^{-2}y}{x^4}\right)^{-2}$

4. Simplify $2a^{-1/6}b^{3/4}$ so there are no negative exponents.

5. Simplify $-5y^{-2/3}$ so there are no negative exponents.

6. Simplify $(27)^{2/3}$

7. Simplify $(-27)^{5/3}$

8. Simplify $(-64)^{2/3}$

9. Simplify $\left(x^{-1/3}y^{2/3}\right)\left(x^{1/3}y^{1/4}\right)$

10. Factor out the common factor $2a$ in $10a^{5/4} - 4a^{8/5}$

11. Factor out the common factor $2a$ in $6a^{4/3} - 8a^{3/2}$

12. Factor out the common factor $3x$ in $21x^{13/8} - 12x^{4/3}$

Solutions

1. The rules of exponents are:

- $x^0 = 1$ if $x \neq 0$ (0^0 is indeterminant and is dealt with in calculus).
- Product Rule: $x^a \cdot x^b = x^{a+b}$.
- Quotient Rule: $\dfrac{x^a}{x^b} = x^{a-b}$.
- Power Rule: $(x^a)^b = x^{ab}$.
- Product Raised to Power Rule: $(xy)^a = x^a y^a$.
- Quotient Raised to a Power Rule: $\left(\dfrac{x}{y}\right)^a = \dfrac{x^a}{y^a}$ if $y \neq 0$.
- Negative Exponent: $x^{-n} = \dfrac{1}{x^n}$, if $x \neq 0$.

2.

$$\begin{aligned}\left(\frac{3xy^{-2}}{y^3}\right)^{-2} &= \frac{(3)^{-2}(x)^{-2}(y^{-2})^{-2}}{(y^3)^{-2}} \text{ Using Power Rule}\\ &= \frac{y^4}{3^2x^2(y^{-6})} \text{ Simplify, using Power Rule and Negative Exponent Rule}\\ &= \frac{y^4y^6}{9x^2} \text{ Simplify, using Negative Exponent Rule}\\ &= \frac{y^{4+6}}{9x^2} \text{ Simplify, using Product Rule}\\ &= \frac{y^{10}}{9x^2} \text{ Simplify}\end{aligned}$$

3.

$$\begin{aligned}\left(\frac{5x^{-2}y}{x^4}\right)^{-2} &= \frac{5^{-2}x^4y^{-2}}{x^{-8}}\\ &= \frac{x^4x^8}{5^2y^2} = \frac{x^{12}}{25y^2}\end{aligned}$$

4. $2a^{-1/6}b^{3/4} = \dfrac{2b^{3/4}}{a^{1/6}}$.

5. $-5y^{-2/3} = \dfrac{-5}{y^{2/3}}$.

6. $(27)^{2/3} = \left(3^3\right)^{2/3} = (3)^2 = 9$.

7. $(-27)^{5/3} = \left((-3)^3\right)^{5/3} = (-3)^5 = -243$.

8. $(-64)^{2/3} = \left((-4)^3\right)^{2/3} = (-4)^2 = 16$.

9. $\left(x^{-1/3}y^{2/3}\right)\left(x^{1/3}y^{1/4}\right) = x^{-1/3+1/3}y^{2/3+1/4} = x^0y^{8/12+3/12} = y^{11/12}$

10. $10a^{5/4} - 4a^{8/5} = 2a \cdot 5a^{1/4} - 2a \cdot 2a^{3/5} = 2a(5a^{1/4} - 2a^{3/5})$.

11. $6a^{4/3} - 8a^{3/2} = 2a \cdot 3a^{1/3} - 2a \cdot 4a^{1/2} = 2a(3a^{1/3} - 4a^{1/2})$.

12. $21x^{13/8} - 12x^{4/3} = 3x \cdot 7x^{5/8} - 3x \cdot 4x^{1/3} = 3x(7x^{5/8} - 4x^{1/3})$.