Multiplication of Rational Expressions:

If a, b, c, & d are real numbers with $b \neq 0$ and $d \neq 0$

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$$

Simplification of Rational Expressions:

If a, b, and r are real numbers with $b \neq 0$ and $r \neq 0$, then

$$\frac{a \cdot r}{b \cdot r} = \frac{a}{b}$$

Ex 1) Simplify: $\dfrac{36}{48}$

$\dfrac{3 \cdot 3 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3}$ Reduce or simplify FACTORS not TERMS...

$= \dfrac{3 \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{2}}{2 \cdot 2 \cdot \cancel{2} \cdot 2 \cdot \cancel{3}}$

$= \boxed{\dfrac{3}{4}}$

Ex 2) Simplify: $\dfrac{36x^3y^5}{27xy^3}$

$$\dfrac{2 \cdot 2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y}{3 \cdot 3 \cdot 3 \cdot x \cdot y \cdot y \cdot y}$$

$$\dfrac{2 \cdot 2 \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{x} \cdot x \cdot x \cdot \cancel{y} \cdot y \cdot \cancel{y} \cdot y \cdot y}{\cancel{3} \cdot \cancel{3} \cdot 3 \cdot \cancel{x} \cdot \cancel{y} \cdot y \cdot \cancel{y}}$$

$$\boxed{\dfrac{4x^2y^2}{3}}$$

The Laws of Exponents:
If m and n are positive integers and a and b are real numbers
with $a \neq 0$ and $b \neq 0$ when they are divisors, then:

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

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

$$\left(a^m\right)^n = a^{mn}$$

$$\text{If } m > n, \quad \frac{a^m}{a^n} = a^{m-n}$$

$$\text{If } m < n, \quad \frac{a^m}{a^n} = \frac{1}{a^{n-m}}$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

Ex 3) Simplify: $\dfrac{3^7}{3^4}$

$= 3^{7-4}$

$= 3^3$

$= \boxed{27}$

Ex 4) Simplify: $\dfrac{7y^5}{y^7}$

$= \dfrac{7}{y^{7-5}}$

$= \boxed{\dfrac{7}{y^2}}$

Ex 5) Simplify: $\left(\dfrac{x^2}{y^3}\right)^3$

$= \dfrac{\left(x^2\right)^3}{\left(y^3\right)^3}$

$= \dfrac{x^6}{y^9}$

Ex 6) Simplify: $\dfrac{\left(xy^2z^3\right)^3}{\left(x^2y^3z^4\right)^2}$

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

$$= \frac{x^3 y^6 z^9}{x^4 y^6 z^8}$$

$$= \boxed{\frac{z}{x}}$$