



**Learning Objective:** Multiplication, division and negative index laws.

## Index Law for further powers:

$(a^m)^n = a^{m \times n}$	$(a \times b)^m = a^m \times b^m$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
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- Raise any coefficient to the power outside grouping symbols
- Keep the same base
- Multiply the indices

## Example:

Simplify

$(a^4)^3 = a^{4 \times 3}$ $= a^{12}$	$(5k)^2 = 5^2 k^2$ $= 25k^2$	$\left(\frac{2x^3}{y^5}\right)^6 = \frac{2^{1 \times 6} x^{3 \times 6}}{y^{5 \times 6}}$ $= \frac{64x^{18}}{y^{30}}$
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Simplify the following questions.

$$(n^3)^3$$

$$(3d)^4$$

$$\left(\frac{3b^3}{7d^5}\right)^2$$

$$\left(\frac{5g^3}{4h^7}\right)^3$$

Simplify the following, giving answers without negative indices.

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

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

$$\frac{(w^{-8} v^2)^3}{w^3 v^{-4}}$$

$$\frac{d^6 e^8}{(d^5 e^{-2})^5}$$



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Simplify the following questions.

$$(n^3)^3$$

$$(n^3)^3 = n^{3 \times 3}$$

$$= n^9$$

$$(3d)^4$$

$$(3d)^4 = 3^4 \times d^4$$

$$= 81d^4$$

$$\left(\frac{3b^3}{7d^5}\right)^2$$

$$\left(\frac{3b^3}{7d^5}\right)^2 = \frac{3^2 b^{3 \times 2}}{7^2 d^{5 \times 2}}$$

$$= \frac{9b^6}{49d^{10}}$$

$$\left(\frac{5g^3}{4h^7}\right)^3$$

$$\left(\frac{5g^3}{4h^7}\right)^3 = \frac{5^3 g^{3 \times 3}}{4^3 h^{7 \times 3}}$$

$$= \frac{125g^9}{64h^{21}}$$

Simplify the following, giving answers without negative indices.

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

$$\frac{(x^4 y^3)^4}{x^2 y^{-3}} = \frac{x^{16} y^{12}}{x^2 y^{-3}}$$

$$= x^{16-2} y^{12-(-3)}$$

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

$$= \frac{y^{15}}{x^{18}}$$

$$= \frac{y^5}{x^6}$$

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

$$\frac{a^{-2} b^5}{(a^3 b^{-5})^3} = \frac{a^{-2} b^5}{a^9 b^{-15}}$$

$$= a^{-2-9} b^{5-(-15)}$$

$$= a^{-11} b^{20}$$

$$= \frac{b^{20}}{a^{11}}$$

$$\frac{(w^8 v^2)^3}{w^3 v^{-4}}$$

$$\frac{(w^8 v^2)^3}{w^3 v^{-4}} = \frac{w^{24} v^6}{w^3 v^{-4}}$$

$$= w^{24-3} v^{6-(-4)}$$

$$= w^{21} v^{10}$$

$$= \frac{v^{10}}{w^{27}}$$

$$\frac{d^{-6} e^8}{(d^5 e^{-2})^5}$$

$$\frac{d^{-6} e^8}{(d^5 e^{-2})^5} = \frac{d^{-6} e^8}{d^{25} e^{-10}}$$

$$= d^{-6-25} e^{8-(-10)}$$

$$= d^{-31} e^{18}$$

$$= \frac{e^{18}}{d^{31}}$$