



YouTube Live Lessons

Getting ready for A-Level Maths...

*"We are what we repeatedly do.
Excellence is not an act, but a habit."*



Laws of indices (3)

Getting ready for A-Level Maths...

What you need...

- Your brain and attention
- A device to watch connected to internet
- A pen and paper
- Can do attitude

Laws of indices (3)

Important rules

$$a^1 = a$$

$$a^0 = 1$$

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

$$a^m \div a^n = \frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$(ka^m)^n = k^n a^{mn}$$

$$a^{-m} = \frac{1}{a^m}$$

$$a^{\frac{1}{m}} = \sqrt[m]{a}$$

$$a^{\frac{n}{m}} = \sqrt[m]{a^n}$$

Laws of indices (3)

My turn

Evaluate the following.

$$3^{-\frac{1}{5}} \times 3^3 \times 3^{\frac{6}{5}}$$

$$\begin{aligned} 3^{-\frac{1}{5}} \times 3^3 \times 3^{\frac{6}{5}} &= 3^{-\frac{1}{5} + 3 + \frac{6}{5}} \quad w \\ &= 3^4 \\ &= \underline{\underline{81}} \end{aligned}$$

$$\begin{aligned} w: -\frac{1}{5} + 3 + \frac{6}{5} &= \frac{5}{5} + 3 \\ &= 1 + 3 \\ &= 4 \end{aligned}$$

Your turn

Evaluate the following.

$$5^{\frac{1}{3}} \times 5^4 \times 5^{-\frac{7}{3}}$$

$$\begin{aligned} 5^{\frac{1}{3}} \times 5^4 \times 5^{-\frac{7}{3}} &= 5^{\frac{1}{3} + 4 + -\frac{7}{3}} \quad w \\ &= 5^2 \\ &= \underline{\underline{25}} \end{aligned}$$

$$\begin{aligned} w: \frac{1}{3} + 4 - \frac{7}{3} &= \frac{1}{3} - \frac{7}{3} + 4 \\ &= -\frac{6}{3} + 4 \\ &= -2 + 4 \\ &= 2 \end{aligned}$$

Laws of indices (3)

My turn

Simplify the following, leaving your answer in index form.

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

$$\begin{aligned} 3^{-\frac{1}{5}} \times 3^4 \times 3^{\frac{9}{5}} &= 3^{-\frac{1}{5} + 4 + \frac{9}{5}} \omega \\ &= \underline{\underline{3^{\frac{28}{5}}}} \end{aligned}$$

$$\begin{aligned} \omega: -\frac{1}{5} + 4 + \frac{9}{5} &= \frac{4}{5} - \frac{1}{5} + 4 \\ &= \frac{3}{5} + 4 \\ &= \frac{3}{5} + \frac{20}{5} \\ &= \frac{23}{5} \end{aligned}$$

Your turn

Simplify the following, leaving your answer in index form.

$$5^{-\frac{1}{3}} \times 5^2 \times 5^{\frac{8}{3}}$$

$$\begin{aligned} 5^{-\frac{1}{3}} \times 5^2 \times 5^{\frac{8}{3}} &= 5^{-\frac{1}{3} + 2 + \frac{8}{3}} \omega \\ &= \underline{\underline{5^{\frac{13}{3}}}} \end{aligned}$$

$$\begin{aligned} \omega: -\frac{1}{3} + 2 + \frac{8}{3} &= \frac{2}{3} - \frac{1}{3} + 2 \\ &= \frac{1}{3} + 2 \\ &= \frac{1}{3} + \frac{2}{1} \\ &= \frac{1}{3} + \frac{6}{3} \\ &= \frac{7}{3} \end{aligned}$$

Laws of indices (3)

My turn

Simplify fully.

$$a^{\frac{2}{3}}b^{\frac{2}{5}} \times a^{\frac{4}{3}}b^{-\frac{12}{5}}$$

$$\begin{aligned} a^{\frac{2}{3}}b^{\frac{2}{5}} \times a^{\frac{4}{3}}b^{-\frac{12}{5}} &= a^{\frac{2}{3}} \times a^{\frac{4}{3}} \times b^{\frac{2}{5}} \times b^{-\frac{12}{5}} \\ &= a^{\frac{2}{3} + \frac{4}{3}} \times b^{\frac{2}{5} + (-\frac{12}{5})} \\ &= a^{\frac{6}{3}} \times b^{-\frac{10}{5}} \\ &= \underline{\underline{a^2 b^{-10}}} \end{aligned}$$

Your turn

Simplify fully.

$$a^{\frac{9}{2}}b^{\frac{3}{4}} \times a^{\frac{7}{2}}b^{-\frac{27}{4}}$$

$$\begin{aligned} a^{\frac{9}{2}}b^{\frac{3}{4}} \times a^{\frac{7}{2}}b^{-\frac{27}{4}} &= a^{\frac{9}{2}} \times a^{\frac{7}{2}} \times b^{\frac{3}{4}} \times b^{-\frac{27}{4}} \\ &= a^{\frac{9}{2} + \frac{7}{2}} \times b^{\frac{3}{4} + (-\frac{27}{4})} \\ &= a^{\frac{16}{2}} \times b^{-\frac{24}{4}} \\ &= \underline{\underline{a^8 b^{-6}}} \end{aligned}$$

Laws of indices (3)

My turn

Simplify fully.

$$\sqrt[3]{a^4} \times \sqrt[3]{27a^2}$$

$$\begin{aligned}\sqrt[3]{a^4} \times \sqrt[3]{27a^2} &= (a^4)^{\frac{1}{3}} \times (27a^2)^{\frac{1}{3}} \\ &= a^{4 \times \frac{1}{3}} \times (27)^{\frac{1}{3}} (a^2)^{\frac{1}{3}} \\ &= a^{\frac{4}{3}} \times 3 \times a^{\frac{2}{3}} \\ &= 3 \times a^{\frac{4}{3}} \times a^{\frac{2}{3}} \\ &= 3 \times a^{\frac{4}{3} + \frac{2}{3}} \\ &= \underline{\underline{3a^2}}\end{aligned}$$

Exam Q

Your turn

Simplify fully.

$$\sqrt{a^5} \times \sqrt{36a}$$

$$\begin{aligned}\sqrt{a^5} \times \sqrt{36a} &= (a^5)^{\frac{1}{2}} \times (36a)^{\frac{1}{2}} \\ &= a^{5 \times \frac{1}{2}} \times (36)^{\frac{1}{2}} (a)^{\frac{1}{2}} \\ &= a^{\frac{5}{2}} \times 6 \times a^{\frac{1}{2}} \\ &= 6 \times a^{\frac{5}{2}} \times a^{\frac{1}{2}} \\ &= 6a^{\frac{5}{2} + \frac{1}{2}} \\ &= \underline{\underline{6a^3}}\end{aligned}$$

Laws of indices (3)

My turn

Simplify fully.

$$\sqrt{a^{\frac{2}{3}} \times a^{\frac{2}{7}}}$$

$$\begin{aligned}\sqrt{a^{\frac{2}{3}} \times a^{\frac{2}{7}}} &= \sqrt{a^{\frac{2}{3} + \frac{2}{7}}} \quad \omega \\ &= \sqrt{a^{\frac{20}{21}}} \\ &= \left(a^{\frac{20}{21}}\right)^{\frac{1}{2}} \\ &= a^{\frac{10}{21} \times \frac{1}{2}} \\ &= \underline{\underline{a^{\frac{5}{21}}}}\end{aligned}$$

$$\begin{aligned}\omega: \frac{2}{3} + \frac{2}{7} &= \frac{2 \times 7}{3 \times 7} + \frac{2 \times 3}{7 \times 3} \\ &= \frac{14}{21} + \frac{6}{21} \\ &= \frac{20}{21}\end{aligned}$$

Exam Q

Your turn

Simplify fully.

$$\sqrt[3]{a^{\frac{3}{4}} \times a^{\frac{3}{5}}}$$

$$\begin{aligned}\sqrt[3]{a^{\frac{3}{4}} \times a^{\frac{3}{5}}} &= \sqrt[3]{a^{\frac{3}{4} + \frac{3}{5}}} \\ &= \sqrt[3]{a^{\frac{27}{20}}} \\ &= \left(a^{\frac{27}{20}}\right)^{\frac{1}{3}} \\ &= a^{\frac{27}{20} \times \frac{1}{3}} \\ &= \underline{\underline{a^{\frac{9}{20}}}}\end{aligned}$$

$$\begin{aligned}\omega: \frac{3}{4} + \frac{3}{5} &= \frac{15}{20} + \frac{12}{20} \\ &= \frac{27}{20}\end{aligned}$$

Exam Q

Laws of indices (3)

Review Exercise

1. Evaluate the following.

$$2^{-\frac{1}{4}} \times 2^5 \times 2^{\frac{13}{4}}$$

2. Simplify the following, leaving your answer in index form.

$$2^{-\frac{1}{3}} \times 2^4 \times 2^{\frac{11}{3}}$$

3. Simplify fully.

$$a^{\frac{3}{4}} b^{\frac{2}{3}} \times a^{\frac{5}{4}} b^{\frac{-14}{3}}$$

4. Simplify fully.

$$\sqrt[4]{a^7} \times \sqrt[4]{625a^5}$$

5. Simplify fully.

$$\sqrt[4]{a^{\frac{4}{5}} \times a^{\frac{4}{7}}}$$

Laws of indices (3)

Review Exercise (Answers)

1. Evaluate the following.

$$2^{-\frac{1}{4}} \times 2^5 \times 2^{\frac{13}{4}}$$

256

2. Simplify the following, leaving your answer in index form.

$$2^{-\frac{1}{3}} \times 2^4 \times 2^{\frac{11}{3}}$$

$2^{\frac{22}{3}}$

3. Simplify fully.

$$a^{\frac{3}{4}} b^{\frac{2}{3}} \times a^{\frac{5}{4}} b^{\frac{-14}{3}}$$

$a^2 b^{-4}$

4. Simplify fully.

$$\sqrt[4]{a^7} \times \sqrt[4]{625a^5}$$

$5a^3$

5. Simplify fully.

$$\sqrt[4]{a^{\frac{4}{5}} \times a^{\frac{4}{7}}}$$

$a^{\frac{12}{35}}$