



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 (2)

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 (2)

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 (2)

My turn

Evaluate:

$$64^{\frac{1}{3}}$$

$$64^{\frac{1}{3}} = \sqrt[3]{64}$$

$$64^{\frac{1}{3}} = \underline{\underline{4}}$$

Your turn

Evaluate:

$$169^{\frac{1}{2}}$$

$$169^{\frac{1}{2}} = \sqrt{169}$$

$$169^{\frac{1}{2}} = \underline{\underline{13}}$$

Laws of indices (2)

My turn

Evaluate:

$$16^{\frac{5}{4}}$$

$$16^{\frac{5}{4}} = (16^{\frac{1}{4}})^5$$

$$= (\sqrt[4]{16})^5$$

$$= 2^5$$

$$16^{\frac{5}{4}} = \underline{\underline{32}}$$

Your turn

Evaluate:

$$27^{\frac{2}{3}}$$

$$27^{\frac{2}{3}} = (27^{\frac{1}{3}})^2$$

$$= 3^2$$

$$= \underline{\underline{9}}$$

Laws of indices (2)

My turn

Evaluate:

$$81^{-\frac{3}{4}}$$

$$81^{\frac{3}{4}} = (81^{\frac{1}{4}})^3$$

$$= 3^3$$

$$81^{\frac{3}{4}} = 27$$

$$81^{-\frac{3}{4}} = \frac{1}{27}$$

Your turn

Evaluate:

$$36^{-\frac{3}{2}}$$

$$36^{\frac{3}{2}} = (36^{\frac{1}{2}})^3$$

$$= 6^3$$

$$36^{\frac{3}{2}} = 216$$

$$36^{-\frac{3}{2}} = \frac{1}{216}$$

Laws of indices (2)

My turn

Evaluate:

$$\left(\frac{64}{125}\right)^{-\frac{2}{3}}$$

$$\left(\frac{64}{125}\right)^{\frac{2}{3}} = \frac{64^{\frac{2}{3}}}{125^{\frac{2}{3}}}$$

$$= \frac{(64^{\frac{1}{3}})^2}{(125^{\frac{1}{3}})^2}$$

$$= \frac{(4)^2}{(5)^2}$$

$$\left(\frac{64}{125}\right)^{\frac{2}{3}} = \frac{16}{25}$$

$$\left(\frac{64}{125}\right)^{-\frac{2}{3}} = \frac{1}{\frac{16}{25}} = \frac{25}{16}$$

Your turn

Evaluate:

$$\left(\frac{32}{243}\right)^{-\frac{3}{5}}$$

$$\left(\frac{32}{243}\right)^{\frac{3}{5}} = \frac{32^{\frac{3}{5}}}{243^{\frac{3}{5}}}$$

$$= \frac{(32^{\frac{1}{5}})^3}{(243^{\frac{1}{5}})^3}$$

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

$$\left(\frac{32}{243}\right)^{\frac{3}{5}} = \frac{8}{27}$$

$$\left(\frac{32}{243}\right)^{-\frac{3}{5}} = \frac{27}{8}$$

Laws of indices (2)

My turn

Express the following in the form x^n .

$$\sqrt[3]{x^5}$$

$$\begin{aligned}\sqrt[3]{x^5} &= (x^5)^{\frac{1}{3}} \\ &= x^{\frac{5}{3}}\end{aligned}$$

Your turn

Express the following in the form x^n .

$$\sqrt[6]{x^7}$$

$$\begin{aligned}\sqrt[6]{x^7} &= (x^7)^{\frac{1}{6}} \\ &= x^{\frac{7}{6}}\end{aligned}$$

Laws of indices (2)

My turn

Express the following in the form x^n .

$$\frac{\sqrt[5]{x}}{x}$$

$$\begin{aligned}\frac{\sqrt[5]{x}}{x} &= \frac{x^{\frac{1}{5}}}{x^1} \\ &= x^{\frac{1}{5}-1} \\ &= \underline{\underline{x^{-\frac{4}{5}}}}\end{aligned}$$

Your turn

Express the following in the form x^n .

$$\frac{\sqrt[3]{x}}{x^2}$$

$$\begin{aligned}\frac{\sqrt[3]{x}}{x^2} &= \frac{x^{\frac{1}{3}}}{x^2} \\ &= x^{\frac{1}{3}-2} \quad \checkmark \\ &= \underline{\underline{x^{-\frac{5}{3}}}}\end{aligned}$$

$$\begin{aligned}w: \frac{1}{3} - \frac{2}{1} &= \frac{1}{3} - \frac{6}{3} \\ &= \underline{\underline{-\frac{5}{3}}}\end{aligned}$$

Laws of indices (2)

My turn

Express the following in the form ax^n , where a is an integer.

$$\left(\frac{2}{\sqrt[7]{x}}\right)^5$$

$$\begin{aligned}\left(\frac{2}{\sqrt[7]{x}}\right)^5 &= \frac{2^5}{(\sqrt[7]{x})^5} \\ &= \frac{32}{(x^{\frac{1}{7}})^5} \\ &= \frac{32}{x^{\frac{5}{7}}} \\ &= \underline{\underline{32x^{-\frac{5}{7}}}}\end{aligned}$$

Exam Q

Your turn

Express the following in the form ax^n , where a is an integer.

$$\left(\frac{3}{\sqrt[9]{x}}\right)^4$$

$$\begin{aligned}\left(\frac{3}{\sqrt[9]{x}}\right)^4 &= \frac{3^4}{(\sqrt[9]{x})^4} \\ &= \frac{81}{(x^{\frac{1}{9}})^4} \\ &= \frac{81}{x^{\frac{4}{9}}} \\ &= \underline{\underline{81x^{-\frac{4}{9}}}}\end{aligned}$$

Exam Q

Laws of indices (2)

My turn

Exam Q

Express $7^{\frac{5}{2}}$ in the form $a\sqrt{b}$, where a is an integer and b is a prime number.

$$\begin{aligned}7^{\frac{5}{2}} &= (7^{\frac{1}{2}})^5 \\ &= (\sqrt{7})^5 \\ &= \sqrt{7} \times \sqrt{7} \times \sqrt{7} \times \sqrt{7} \times \sqrt{7} \\ &= 7 \times 7 \times \sqrt{7} \\ &= \underline{\underline{49\sqrt{7}}}\end{aligned}$$

$a=49$ $b=7$

Your turn

Exam Q

Express $5^{\frac{9}{2}}$ in the form $a\sqrt{b}$, where a is an integer and b is a prime number.

$$\begin{aligned}5^{\frac{9}{2}} &= (5^{\frac{1}{2}})^9 \\ &= (\sqrt{5})^9 \\ &= \sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \\ &= 5 \times 5 \times 5 \times 5 \times \sqrt{5} \\ &= 625\sqrt{5}\end{aligned}$$

$a=625$ $b=5$

Laws of indices (2)

My turn

Simplify fully.

$$(8y^9)^{\frac{5}{3}}$$

$$\begin{aligned}(8y^9)^{\frac{5}{3}} &= 8^{\frac{5}{3}} (y^9)^{\frac{5}{3}} \\ &= (8^{\frac{1}{3}})^5 y^{9 \times \frac{5}{3}} \\ &= (2)^5 y^{15} \\ &= \underline{\underline{32y^{15}}}\end{aligned}$$

Exam Q

Your turn

Simplify fully.

$$(81y^8)^{\frac{3}{4}}$$

$$\begin{aligned}(81y^8)^{\frac{3}{4}} &= (81)^{\frac{3}{4}} (y^8)^{\frac{3}{4}} \\ &= (81^{\frac{1}{4}})^3 y^{8 \times \frac{3}{4}} \\ &= (3)^3 y^6 \\ &= \underline{\underline{27y^6}}\end{aligned}$$

Exam Q

Laws of indices (2)

Review Exercise

1. Evaluate:

$$81^{\frac{1}{4}}$$

2. Evaluate:

$$36^{\frac{3}{2}}$$

3. Evaluate:

$$64^{-\frac{2}{3}}$$

4. Evaluate:

$$\left(\frac{81}{256}\right)^{-\frac{3}{4}}$$

5. Express the following in the form x^n .

$$\sqrt[7]{x^3}$$

6. Express the following in the form x^n .

$$\frac{\sqrt[4]{x}}{x}$$

7. Express the following in the form ax^n , where a is an integer.

$$\left(\frac{4}{\sqrt[5]{x}}\right)^3$$

8. Express $5^{\frac{7}{2}}$ in the form $a\sqrt{b}$, where a is an integer and b is a prime number.

9. Simplify fully.

$$(32y^{10})^{\frac{6}{5}}$$

Laws of indices (2)

Review Exercise (Answers)

1. Evaluate:

$$81^{\frac{1}{4}} \quad 3$$

2. Evaluate:

$$36^{\frac{3}{2}} \quad 216$$

3. Evaluate:

$$64^{-\frac{2}{3}} \quad \frac{1}{16}$$

4. Evaluate:

$$\left(\frac{81}{256}\right)^{-\frac{3}{4}} \quad \frac{64}{27} \text{ or } 2\frac{10}{27}$$

5. Express the following in the form x^n .

$$\sqrt[7]{x^3} \quad x^{\frac{3}{7}}$$

6. Express the following in the form x^n .

$$\frac{\sqrt[4]{x}}{x} \quad x^{-\frac{3}{4}}$$

7. Express the following in the form ax^n , where a is an integer.

$$\left(\frac{4}{\sqrt[5]{x}}\right)^3 \quad 64x^{-\frac{3}{5}}$$

8. Express $5^{\frac{7}{2}}$ in the form $a\sqrt{b}$, where a is an integer and b is a prime number.

$$125\sqrt{5}$$

9. Simplify fully.

$$(32y^{10})^{\frac{6}{5}} \quad 64y^{12}$$