



Indices 1

1 Index laws

Indices include square roots, cube roots and powers.

You can use the index laws to simplify powers and roots.

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

$$4^3 \times 4^7 = 4^{3+7} = 4^{10}$$

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

$$12^8 \div 12^3 = 12^{8-3} = 12^5$$

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

$$(7^3)^5 = 7^3 \times 5 = 7^{15}$$

2 Cube root

The cube root of a positive number is positive.

$$4 \times 4 \times 4 = 64$$

$$4^3 = 64$$

$$\sqrt[3]{64} = 4$$

The cube root of a negative number is negative.

$$-4 \times -4 \times -4 = -64$$

$$(-4)^3 = -64$$

$$\sqrt[3]{-64} = -4$$

3 Powers of 0 and 1

Anything raised to the power 0 is equal to 1

$$6^0 = 1 \quad 1^0 = 1 \quad 7223^0 = 1 \quad (-5)^0 = 1$$

Anything raised to the power 1 is equal to itself.

$$8^1 = 8 \quad 499^1 = 499 \quad (-3)^1 = -3$$

Indices checklist

The base numbers have to be the same.

If there's no index, the number has the power 1

Be careful with negatives: $(-3)^2 = 9$

Worked example

Work out the value of

(a) $\frac{6^3 \times 6}{6^2}$

$$\frac{6^3 \times 6^1}{6^2} = \frac{6^{3+1}}{6^2} = \frac{6^4}{6^2} = 6^2 = 36$$

(b) $100^0 + 2 \times \sqrt[3]{-27}$

$$\begin{aligned} 100^0 + 2 \times \sqrt[3]{-27} &= 1 + 2 \times (-3) \\ &= 1 + (-6) \\ &= -5 \end{aligned}$$



Use the index laws to simplify your calculations as much as possible.

Always use the correct order of operations:

Brackets Indices Divide Multiply
Add Subtract

Tip!

- 'Work out the value of' means 'evaluate' so the final answer must be a number.
- You need to be able to remember the cubes of 2, 3, 4, 5 and 10 and their corresponding cube roots.

Now try this

1. (a) Work out the value of $3^6 \div 3^2$ (1 mark)

(b) Work out the value of $\frac{(2^4)^5}{2^{17}}$ (1 mark)



2. (a) Simplify $(a^2)^4$ (1 mark)

(b) Work out the value of x when $2^{30} \div 8^9 = 2^x$ (2 marks)



In part (b), convert 8 to a power of 2 and then use the index laws.