

## Equations with Indices

### Starter

- (Review of last lesson)** Without a calculator, evaluate  $1000^{\frac{5}{3}}$ .
- (Review of last lesson)** Simplify: (a)  $(16x^{12})^{\frac{3}{4}}$  (b)  $(64y^{21})^{\frac{2}{3}}$

### Notes

An equation involving indices may look some something like this:

$$\begin{array}{c}
 \text{powers} \\
 \swarrow \quad \searrow \\
 3^{2x-1} = 27^x \\
 \nwarrow \quad \nearrow \\
 \text{base numbers}
 \end{array}$$

In order to solve such an equation the **base numbers** must be the **same**.

i.e. **express** the **big number** as a **power of** the **smaller number**

### Success criteria – solving equation involving indices

- Make sure both base numbers are the same — this usually means expressing the bigger number as a power of the smaller number.
- Form an equation by **equating powers of the base number**.
- Solve the equation.

**E.g. 1** Solve  $3^x = 81$ .

**Working:** **Replace 81 by  $3^4$ :**  $3^x = 3^4$   
**Equating powers of 3:**  $x = 4$

**E.g. 2** Solve: (a)  $5^{2x+1} = 125$  (b)  $2^{1-4x} = 128$  (c)  $3^{5x-2} = 27$

**Working:** (a) **Replace 125 by  $5^3$ :**  $5^{2x+1} = 5^3$   
**Equating powers of 5:**  $2x + 1 = 3$   
 $2x = 2$   
 $x = 1$

**E.g. 3** Solve: (a)  $2^x = \frac{1}{8}$  (b)  $4^{3-2x} = \frac{1}{64}$  (c)  $3^{2x-5} = \frac{1}{81}$

**Working:** (a) **Replace 8 by  $2^3$ :**  $2^x = \frac{1}{2^3}$   
**Equating powers of 2:**  $2^x = 2^{-3}$   
 $x = -3$

Video: [Equations with indices](#)

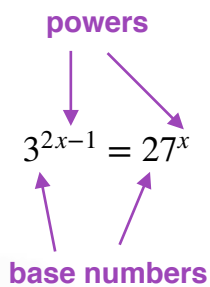
[Solutions to Starter and E.g.s](#)

**Exercise**

9-1 class textbook: p48 E2.3 Qu 1, 2, 3ace., 4  
A\*-G class textbook: p45 E2.4 Qu 1, 2, 3ace., 4  
9-1 homework book: p16 E2.3 Qu 1, 2, 3a  
A\*-G homework book: p12 E2.4 Qu 1, 2, 3a



## Summary



Solving equation involving indices

1. Make sure both base numbers are the same — this usually means expressing the bigger number as a power of the smaller number.
2. Form an equation by equating powers of the base number.
3. Solve the equation.

[Homework book answers \(only available during a lockdown\)](#)