
Equations with Indices

Starter

1. **(Review of last lesson)** Without a calculator, evaluate $1000^{\frac{5}{3}}$.

Working: $1000^{\frac{5}{3}} = \left(\sqrt[3]{1000}\right)^5 = 10^5 = 100000$

2. **(Review of last lesson)** Simplify: (a) $(16x^{12})^{\frac{3}{4}}$ (b) $(64y^{21})^{\frac{2}{3}}$

Working: (a) $(16x^{12})^{\frac{3}{4}} = (\sqrt[4]{16})^3 \times x^{12 \times \frac{3}{4}} = 2^3 \times x^9 = 8x^9$

(b) $(64y^{21})^{\frac{2}{3}} = (\sqrt[3]{64})^2 \times y^{21 \times \frac{2}{3}} = 4^2 \times y^{14} = 16y^{14}$

- 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: $2x + 1 = 3$
 $2x = 2$
 $x = 1$

(b) *Replace 128 by 2^7 :* $2^{1-4x} = 2^7$
Equating powers of 2: $1 - 4x = 7$
 $-4x = 6$
 $x = -\frac{3}{2}$

(c) *Replace 27 by 3^3 :* $3^{5x-2} = 3^3$
Equating powers of 3: $5x - 2 = 3$
 $5x = 5$
 $x = 1$

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 :* $2^x = \frac{1}{2^3}$
 $2^x = 2^{-3}$
Equating powers of 2: $x = -3$

(b) *Replace 64 by 4^3 :* $4^{3-2x} = \frac{1}{4^3}$
 $4^{3-2x} = 4^{-3}$
Equating powers of 4: $3 - 2x = -3$
 $-2x = -6$
 $x = 3$

(c) *Replace 81 by 3^4 :* $3^{2x-5} = \frac{1}{3^4}$
 $3^{2x-5} = 3^{-4}$
Equating powers of 3: $2x - 5 = -4$
 $2x = 1$
 $x = \frac{1}{2}$

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

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