

Equations with Indices (Harder)

Starter

1. (Review of last lesson) Solve: (a) $2^{4x-1} = \frac{1}{16}$ (b) $4 = 64^{3x+1}$

Working: (a) *Replace 16 by 2^4 :* $2^{4x-1} = \frac{1}{2^4}$
 $2^{4x-1} = 2^{-4}$
Equating powers of 4: $4x - 1 = -4$
 $4x = -3$
 $x = -\frac{3}{4}$

(b) *Replace 64 by 4^3 :* $4 = (4^3)^{3x+1}$
3rd law of logs: $4^1 = 4^{9x+3}$
Equating powers of 4: $1 = 9x + 3$
 $-2 = 9x$
 $x = -\frac{2}{9}$

E.g. 1 Solve: (a) $4^{3x} = 8^{7x+1}$ (b) $9^{2x+1} = 27^{7-5x}$ (c) $8^{2x-1} = \left(\frac{1}{16}\right)^{3x+5}$

Working: (a) *The number 2 connects 4 and 8.*
Replace 4 by 2^2 and 8 by 2^3 : $(2^2)^{3x} = (2^3)^{7x+1}$
3rd law of logs: $2^{6x} = 2^{21x+3}$
Equating powers of 2: $6x = 21x + 3$
 $-15x = 3$
 $x = -\frac{1}{5}$

(b) *The number 3 connects 9 and 27.*
Replace 9 by 3^2 and 27 by 3^3 : $(3^2)^{2x+1} = (3^3)^{7-5x}$
3rd law of logs: $3^{4x+2} = 3^{21-15x}$
Equating powers of 3: $4x + 2 = 21 - 15x$
 $19x = 19$
 $x = 1$

(c) *The number 2 connects 8 and 16.*
Replace 8 by 2^3 and 16 by 2^4 : $(2^3)^{2x-1} = \frac{1}{(2^4)^{3x+5}}$
3rd law of logs: $2^{6x-3} = \frac{1}{2^{12x+20}}$
 $2^{6x-3} = 2^{-12x-20}$
Equating powers of 2: $6x - 3 = -12x - 20$
 $18x = -17$
 $x = -\frac{17}{18}$

Video: [Equations with indices](#)

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

Exercise

9-1 class textbook:	p48 E2.3 Qu 5-6
A*-G class textbook:	p45 E2.4 Qu 5-6
9-1 homework book:	p16 E2.3 Qu 3bi, 4-7
A*-G homework book:	p12 E2.4 Qu 3bi, 4, 5

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

