

Indices (Mixed Problems)

Starter

1. (Review of last lesson) Estimate $\sqrt{137}$.

(Review of Indices material)

2. Simplify: a) $\frac{(a^3)^6 \times a^7}{a^{10}}$ b) $(2p^3q^7)^4$
3. Evaluate (a) $\left(\frac{7}{8}\right)^{-1}$ (b) $\left(\frac{6}{5}\right)^{-2}$ (c) $\left(\frac{1}{7}\right)^{-2}$
 (d) $64^{\frac{1}{3}}$ (e) $16^{-\frac{1}{4}}$ (f) $\left(\frac{81}{100}\right)^{-\frac{1}{2}}$
 (g) $27^{\frac{2}{3}}$ (h) $\left(\frac{8}{27}\right)^{-\frac{2}{3}}$
3. Simplify: (a) $(8a^9)^{\frac{2}{3}}$ (b) $(32a^{10})^{-\frac{2}{5}}$
4. Solve: (a) $3^{2x+7} = 81$ (b) $2^{3-5x} = \frac{1}{32}$ (c) $9^{8x-5} = \left(\frac{1}{27}\right)^2$

Solutions to Starter and E.g.s

Exercise

- 9-1 class textbook: p52 E2.5 Qu 1ace..., 3, 5, 6, 8ace..., 9, 12*, 13*
 A*-G class textbook: p46 E2.5 Qu 1ace..., 3, 5, 6, 7ace..., 8, 11*, 12*
 9-1 homework book: p18 E2.5 Qu 1ace, 2aceg, 3-7, 8ace, 9, 10
 A*-G homework book: p13 E2.5 Qu 1ace, 2aceg, 3-6, 7ace, 8

Summary

$$a^x \times a^y = a^{x+y}$$

$$a^x \div a^y = a^{x-y}$$

$$(a^n)^x = a^{nx}$$

Zero index: $a^0 = 1$

Negative indices: $a^{-x} = \frac{1}{a^x}$ $\frac{1}{a^{-x}} = a^x$

Fractional indices:

$$x^{\frac{1}{n}} = \sqrt[n]{x}$$

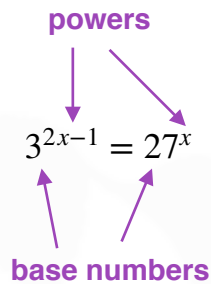
$$\sqrt[n]{a^x} = a^{\frac{x}{n}}$$

$$\sqrt[n]{a^x} = (a^x)^{\frac{1}{n}} \quad \text{or} \quad \sqrt[n]{a^x} = (a^{\frac{1}{n}})^x$$

When evaluating fractional indices, it is easier to **do the root first** as you then have a smaller number to square, cube etc.

With **negative indices**, the first step is to write the reciprocal of the number and change the sign of the power.

When a **fraction** is raised to a negative power, “flip” the fraction and make the power positive.



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.

Solving harder equations with indices:

1. Find the number that links the two base numbers
2. Express the base numbers as the link number raised to a power and replace in the equation.
3. Equate powers of the link number to form an equation.
4. Solve the equation.

Estimating a decimal raised to a power:

1. Write down the integer either side of the decimal.
2. Raise these integers to the same power as the decimals.
3. Base your estimate on the values found in step 2.

Estimating the root of an integer:

1. Find the nearest square/cubic etc. number above and below the number that has to be rooted.
2. Root these numbers.
3. Base your estimate on the values found in step 2.

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