

Estimating Powers and Roots

Starter

1. (Review of last lesson) Solve $9^{32x} = 81^{7x+1}$.

Notes

Find this table in your notebook

	To the power of 2	To the power of 3	To the power of 4	To the power of 5	To the power of 6	To the power of 7	To the power of 8
2	4	8	16	32	64	128	256
3	9	27	81	243	729	2187	
4	16	64	256	1024	4096		
5	25	125	625	3125			
6	36	216	1296				
7	49	343					

Success criteria – estimating a decimal raised to a power

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

E.g. Estimate the value of 4.3^3 .

Working: The integers either side of 4.3 are 4 and 5.

Raise these to the same power as the decimals: $4^3 = 64$ and $5^3 = 125$

So $64 < 4.3^3 < 125$

Since 4.3 is closer to 4, $4.3^3 \approx 80$

N.B. An estimate between 75 and 85 would be fine

E.g. 1 Estimate 2.8^5 .

Success criteria – estimating the root of an integer

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

E.g. 2 Estimate $\sqrt[3]{150}$.

Working: Find the nearest cube numbers above and below 150

$\sqrt[3]{125} = 5$ and $\sqrt[3]{216} = 6$

$\sqrt[3]{125} < \sqrt[3]{150} < \sqrt[3]{216}$

$5 < \sqrt[3]{150} < 6$

150 is closer to 125 than 216

So $\sqrt[3]{150}$ will be closer to 5 than 6

$\sqrt[3]{150} \approx 5.3$

E.g. 3 Estimate: (a) 3.6^4 (b) $\sqrt{40}$ (c) $\sqrt{12}$ (d) $\sqrt[4]{30}$

N.B. Estimating means you need to be able to do the calculation in your head so aim to estimate the numbers to 1 s.f.

E.g. 4 Estimate these calculations, showing your working:

(a)
$$\frac{19.7 + \sqrt{15}}{7.8}$$

(b)
$$\frac{10.7 + 2.1^3}{\sqrt[3]{120}}$$

Working: (a)
$$\frac{19.7 + \sqrt{15}}{7.8} \approx \frac{20 + 4}{8} = 3$$

Video: <https://www.youtube.com/watch?v=GWiUL0c8eJA>

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

Exercise

9-1 class textbook:	p49 E2.4 Qu 3-7
A*-G class textbook:	No exercise
9-1 homework book:	p17 E2.4 Qu 2-10
A*-G homework book:	No exercise

Summary

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 \(only available during a lockdown\)](#)