

Know & use the Index Laws (using numbers) – NA5

Index Laws

$3^0 = 1$ All numbers to the **power 0** are **1**
 $3^a \times 3^b = 3^{a+b}$ For **multiplication** just **add** the indices
 $3^a \div 3^b = 3^{a-b}$ For **division** just **subtract** the indices
 $(3^a)^b = 3^{a \times b}$ For **power** (repeated multiplication) just **multiply** the indices

These are the index laws using the number 3.

The laws work with any number as long as the base number is the same! → So $4^a \times 4^b = 4^{a+b}$

But watch out with $4^a \times 5^b$.

The base numbers are different so index laws don't work!!

Why do the index laws work?

Calculate $3^2 \times 3^4$

3⁴ means 3 × 3 × 3 × 3

3² means 3 × 3

So $3^2 \times 3^4$ means $3 \times 3 \times 3 \times 3 \times 3 \times 3$ which is just 3^6

Hey Look...

This is just the two indices added i.e. 2 + 4

$3^5 \div 3^2$ means $\frac{3^5}{3^2}$ which means $\frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3}$

Cancel the 3's, $\frac{\cancel{3} \times \cancel{3} \times 3 \times 3 \times 3}{\cancel{3} \times \cancel{3}} = 3 \times 3 \times 3 = 3^3$

Hey Look...

This is just the two indices subtracted i.e. 5 - 2

$(3^5)^3$ means $3^5 \times 3^5 \times 3^5$, this means $(3 \times 3 \times 3 \times 3 \times 3) \times (3 \times 3 \times 3 \times 3 \times 3) \times (3 \times 3 \times 3 \times 3 \times 3) = 3^{15}$

We could just add these indices $5 + 5 + 5 = 15!!$

Hey Look...

This is just the two indices, 5 and 3, multiplied i.e. 5 × 3

Your Turn!!

- a) Learn the four index laws above b) Write i) $3^6 \div 3^2$ in the form 3^a ii) $(4^4)^6$ in the form 4^b

Know & use the Index Laws (using letters) – NA5

Index laws

$a^0 = 1$ All numbers to the **power 0** are **1**
 $a^x \times a^y = a^{x+y}$ For **multiplication** just **add** the indices
 $a^x \div a^y = a^{x-y}$ For **division** just **subtract** the indices – also written $\frac{a^x}{a^y} = a^{x-y}$
 $(a^x)^y = a^{xy}$ For **power** (repeated multiplication) just **multiply** the indices

Hey Look...

These laws are essentially the same as above but having replaced the base number 3 with the letter a

Example

a. $a^3 \times a^9 = a^{3+9} = a^{12}$

b. $b^4 \div b^3 = b^{4-3} = b^1 = b$

c. $(c^4)^7 = c^{4 \times 7} = c^{28}$

The letters must be the same for the index laws to work!

Remember...

Numbers to the power 1 are just themselves e.g. $3^1 = 3$ OR $b^1 = b$

Your Turn!!

- c) Learn these four index laws d) Simplify i) $e^5 \div e^2$ ii) $(m^8)^4$

RAPID 'ACID' TEST – Blank out the page above before answering these!

☞ Simplify using the index laws.

1. $3^7 \times 3^8$

2. $3^8 \div 3^7$

3. $(3^8)^7$

4. $x^3 \times x^9$

5. $y^5 \div y^3$

6. $(z^4)^7$