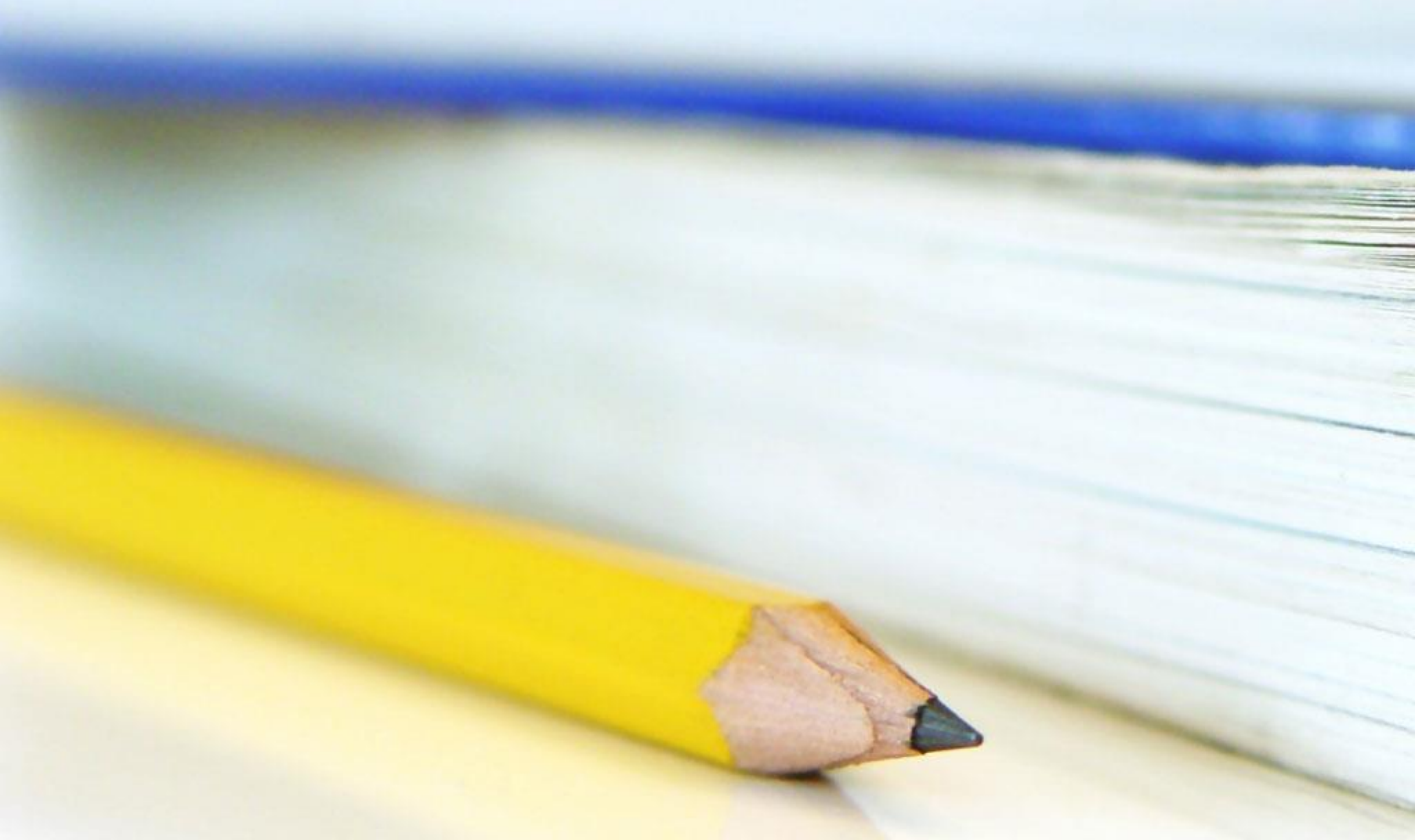
Laws of Indices



What are Indices?

- Indices provide a way of writing numbers in a more convenient form
- Indices is the plural of index
- An index is often referred to as a power

For example

$5 \times 5 \times 5 = 5^3$

$2 \times 2 \times 2 \times 2 = 2^4$

$7 \times 7 \times 7 \times 7 \times 7 = 7^5$

7 is the BASE NUMBER

5 is the INDEX

7^5 & 2^4 are numbers in INDEX FORM

Combining numbers

$$5 \times 5 \times 5 \times 2 \times 2 \times 2 \times 2$$

$$= 5^3 \times 2^4$$

We can not write this any more simply!

<u>Can ONLY do that if BASE NUMBERS are the same</u>

Rule 1 : Multiplication

$2^6 \times 2^4 = 2^{10}$

$2^4 \times 2^2 = 2^6$

$3^5 \times 3^7 = 3^{12}$

General Rule

$a^m \times a^n = a^{m+n}$

Rule 2 : Division

$2^6 \div 2^4 \quad = 3^2$

$2^5 \div 2^2 \quad = 2^3$

$3^5 \div 3^7 \quad = 3^{-2}$

General Rule

$a^m \div a^n = a^{m-n}$

Rule 3 : Brackets

$(2^6)^2 = 2^6 \times 2^6 = 2^{12}$

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

General Rule

$(a^m)^n = a^{m \times n}$

Rule 4 : Index of 0

How could you get an answer of 3^0?

$$3^5 \div 3^5 = 3^{5-5} = 3^0$$

$$3^0 = 1$$

General Rule

$$a^0 = 1$$

Putting them together?

$$\frac{2^6 \times 2^4}{2^3} = \frac{2^{10}}{2^3} = 2^7$$

$$\frac{3^5 \times 3^7}{3^4} = \frac{3^{12}}{3^4} = 3^8$$

$$\frac{2^5 \times 2^3}{2^4 \times 2^2} = \frac{2^8}{2^6} = 2^2$$

Works with algebra too!

$$a^6 \times a^4 = a^{10}$$

$$b^5 \times b^7 = b^{12}$$

$$\frac{c^5 \times c^3}{c^4} = \frac{c^8}{c^4} = c^4$$

$$\frac{a^5 \times a^3}{a^4 \times a^6} = \frac{a^8}{a^{10}} = a^{-2}$$

..and a mixture...

$2a^3 \times 3a^4 = 2 \times 3 \times a^3 \times a^4 = 6a^7$

$8a^6 \div 4a^4 = (8 \div 4) \times (a^6 \div a^4) = 2a^2$

$$\frac{\overset{2}{\cancel{8}}a^{\cancel{6}\,2}}{\cancel{4}a^{\cancel{4}}}$$