GCSE Mathematics — Indices & Surds

base → a^m ← power *or* index *or* exponent

We say 'a to the power of m'

Square numbers

a^2
'the square of a'
'a to the power of 2'

Expanded form	Power form	Evaluated
$1 \times 1 =$	1^2	$= 1$
$2 \times 2 =$	2^2	$= 4$
$3 \times 3 =$	3^2	$= 9$
$4 \times 4 =$	4^2	$= 16$
$5 \times 5 =$	5^2	$= 25$
$6 \times 6 =$	6^2	$= 36$
$7 \times 7 =$	7^2	$= 49$
$8 \times 8 =$	8^2	$= 64$
$9 \times 9 =$	9^2	$= 81$
$10 \times 10 =$	10^2	$= 100$
$11 \times 11 =$	11^2	$= 121$
$12 \times 12 =$	12^2	$= 144$

Square roots

$\sqrt{a}$
'the square root of a'

Root form	Evaluated
$\sqrt{1} =$	$= 1$
$\sqrt{4} =$	$= 2$
$\sqrt{9} =$	$= 3$
$\sqrt{16} =$	$= 4$
$\sqrt{25} =$	$= 5$
$\sqrt{36} =$	$= 6$
$\sqrt{49} =$	$= 7$
$\sqrt{64} =$	$= 8$
$\sqrt{81} =$	$= 9$
$\sqrt{100} =$	$= 10$
$\sqrt{121} =$	$= 11$
$\sqrt{144} =$	$= 12$

Cube numbers

a^3
'the cube of a'
'a to the power of 3'

Expanded form	Power form	Evaluated
$1 \times 1 \times 1 =$	1^3	$= 1$
$2 \times 2 \times 2 =$	2^3	$= 8$
$3 \times 3 \times 3 =$	3^3	$= 27$
$4 \times 4 \times 4 =$	4^3	$= 64$
$5 \times 5 \times 5 =$	5^3	$= 125$
$6 \times 6 \times 6 =$	6^3	$= 216$
$7 \times 7 \times 7 =$	7^3	$= 343$
$8 \times 8 \times 8 =$	8^3	$= 512$
$9 \times 9 \times 9 =$	9^3	$= 729$
$10 \times 10 \times 10 =$	10^3	$= 1000$

Cube roots

$\sqrt[3]{a}$
'the cube root of a'

Root form	Evaluated
$\sqrt[3]{1} =$	$= 1$
$\sqrt[3]{8} =$	$= 2$
$\sqrt[3]{27} =$	$= 3$
$\sqrt[3]{64} =$	$= 4$
$\sqrt[3]{125} =$	$= 5$
$\sqrt[3]{216} =$	$= 6$
$\sqrt[3]{343} =$	$= 7$
$\sqrt[3]{512} =$	$= 8$
$\sqrt[3]{729} =$	$= 9$
$\sqrt[3]{1000} =$	$= 10$

$x^4 = x \times x \times x \times x$	Multiply by x ↑
$x^3 = x \times x \times x$	
$x^2 = x \times x$	
$x^1 = x$	
$x^0 = 1$	
$x^{-1} = \frac{1}{x}$	
$x^{-2} = \frac{1}{x \times x}$	
$x^{-3} = \frac{1}{x \times x \times x}$	Divide by x ↓

Index Laws

For powers of the same base

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

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

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

Further notes: