KS3 Unit 4 Squares, Cubes, Roots and BIDMAS and Unit 5 Index Rules

Topic/Skill	Definition/Tips	Example
1. BIDMAS	An acronym for the **order** you should do calculations in. BIDMAS stands for **'Brackets, Indices, Division, Multiplication, Addition and Subtraction'**. Indices are also known as 'powers' or 'orders'. With strings of division and multiplication, or strings of addition and subtraction, and no brackets, work from left to right.	$6 + 3 \times 5 = 21, not\ 45$ $5^2 = 25$, where the 2 is the index/power. $12 \div 4 \div 2 = 1.5, not\ 6$
2. Square Number	The number you get when you **multiply a number by itself**.	**1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225...** $9^2 = 9 \times 9 = 81$
3. Square Root	The **number you multiply by itself** to get another number. The reverse process of squaring a number.	$\sqrt{36} = 6$ because $6 \times 6 = 36$
4. Solutions to $x^2 = \ ....$	**Equations** involving **squares** have **two solutions**, one **positive** and one **negative**.	Solve $x^2 = 25$ $x = 5\ or\ x = -5$ This can also be written as $x = \pm 5$
5. Cube Number	The number you get when you **multiply a number by itself and itself again**.	1, 8, 27, 64, 125... $2^3 = 2 \times 2 \times 2 = 8$
6. Cube Root	The **number you multiply by itself and itself again** to get another number. The reverse process of cubing a number.	$\sqrt[3]{125} = 5$ because $5 \times 5 \times 5 = 125$
7. Powers of...	The powers of a number are that **number raised to various powers**.	The powers of 3 are: $3^1 = 3$ $3^2 = 9$ $3^3 = 27$ $3^4 = 81$ etc.
8. Multiplication Index Law	When **multiplying** with the same base (number or letter), **add the powers**. $$a^m \times a^n = a^{m+n}$$	$7^5 \times 7^3 = 7^8$ $a^{12} \times a = a^{13}$ $4x^5 \times 2x^8 = 8x^{13}$
9. Division Index Law	When **dividing** with the same base (number or letter), **subtract the powers**. $$a^m \div a^n = a^{m-n}$$	$15^7 \div 15^4 = 15^3$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$
10. Brackets Index Laws	When raising a power to another power, multiply the powers together.	$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$

	$(a^m)^n = a^{mn}$	
11. Notable Powers	$p = p^1$ $p^0 = 1$	$99999^0 = 1$
12. Negative Powers	A negative power performs the reciprocal. $a^{-m} = \dfrac{1}{a^m}$	$3^{-2} = \dfrac{1}{3^2} = \dfrac{1}{9}$
13. Fractional Powers	The denominator of a fractional power acts as a 'root'. The numerator of a fractional power acts as a normal power. $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$	$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = 3^2 = 9$ $\left(\dfrac{25}{16}\right)^{\frac{3}{2}} = \left(\dfrac{\sqrt{25}}{\sqrt{16}}\right)^3 = \left(\dfrac{5}{4}\right)^3 = \dfrac{125}{64}$