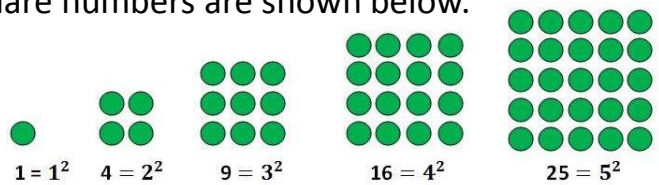
Knowledge Organiser: Indices, Powers and Roots

What you need to know:

Squares, cubes and roots

Square numbers: This is when we multiply a number by itself, the first 5 square numbers are shown below.



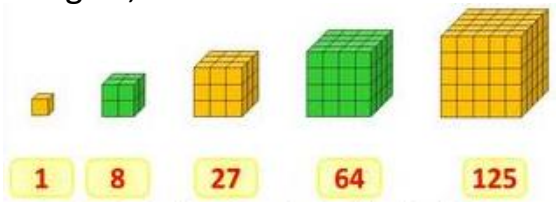
Square roots: This is the number that we started with to get the square numbers.

Remember the answer is 7 not 7x7.

$\sqrt{49}$ = 7 because 7x7 is 49

$\sqrt{100}$ = 10 because 10x10 is 10

Cube numbers: This is when we multiply a number by itself and then by itself again, the first 5 cube numbers are shown below.



Index form

Index number: An index number is a number which is raised to a power. The power, also known as the index, tells you how many times you have to multiply the number by itself.

2^5 is the index notation.

$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Key Terms:

Square: A square number is the result of multiplying a number by itself.
Cube: A cube number is the result of multiplying a number by itself twice.
Root: A root is the reverse of a power.
Indices: These are the squares, cubes and powers.

Operation: In maths these are the functions × ÷ + -.

Hegarty maths clip numbers

Powers and Roots: 99 – 102

Laws of Indices: 105, 106 and 110

hegartymaths

You need to be able to:

- Recognise and calculate square numbers and roots.
- Recognise and calculate cube numbers and roots.
- Complete calculations with a mixture of powers and roots.
- Use BIDMAS to complete calculations.
- Use the laws of indices to simplify expressions.

Knowledge Organiser: Indices, Powers and Roots

What you need to know:

Laws of indices

Multiplication law: When multiplying with the same base (number/letter) we add the powers.

General rule: $a^m \times a^n = a^{m+n}$

$2^5 \times 2^7 = 2^{5+7} = 2^{12}$ $\quad\quad$ $x^3 \times x^8 = x^{3+8} = x^{11}$

When multiplying the terms we add the powers together.

Division law: When dividing with the same base (number/letter) we subtract the powers.

General rule: $a^m \div a^n = a^{m-n}$

$2^{14} \div 2^7 = 2^{14-7} = 2^7$ $\quad\quad$ $x^{10} \div x^8 = x^{10-8} = x^2$

When dividing the terms we subtract the powers together.

Brackets law: When raising a power to another power we multiply the powers together.

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

$(5^4)^2 = 5^{4 \times 2} = 5^8$ $\quad\quad$ $(h^9)^3 = h^{9 \times 3} = h^{27}$

When raising to a power we multiply the powers together.

BIDMAS – order of operations

B Brackets

I Indices

D Division

M Multiplication

A Addition

S Subtraction

If a calculation contains the circled calculations then you need to work from left to right.

$5 \times 4 - 8 \div 2$

This question can be split into two separate calculations which are then combined to get the answer.

$20 - 4 = \mathbf{16}$

We need to deal with the powers inside the brackets first by calculating 2^2.

$(2^2 + 6)^2 \times 4 - 8$

$(4 + 6)^2 \times 4 - 8$

$(10)^2 \times 4 - 8$

Once the bracket has been fully calculated we then look at the operations on the outside of the bracket.

$100 \times 4 - 8$

$400 - 8 = \mathbf{392}$