INDICES

The index of a number says how many times to use the number in a multiplication.

It is written as a small number to the right and above the base number.

In this example: $8^2 = 8 \times 8 = 64$

The plural of index is indices.

(Other names for index are **exponent** or **power**.)

The **exponent** of a number says **how many times** to use the number in a multiplication.

In $\mathbf{8^2}$ the "2" says to use 8 twice in a multiplication,
so $\mathbf{8^2 = 8 \times 8 = 64}$

In words: 8^2 could be called "8 to the power 2" or "8 to the second power", or simply "8 squared"

Exponents are also called Powers or Indices.

Some more examples:

Example: $\mathbf{5^3 = 5 \times 5 \times 5 = 125}$

- In words: 5^3 could be called "5 to the third power", "5 to the power 3" or simply "5 cubed"

Example: $\mathbf{2^4 = 2 \times 2 \times 2 \times 2 = 16}$

- In words: 2^4 could be called "2 to the fourth power" or "2 to the power 4" or simply "2 to the 4th"

Exponents make it easier to write and use many multiplications

Example: $\mathbf{9^6}$ is easier to write and read than $\mathbf{9 \times 9 \times 9 \times 9 \times 9 \times 9}$

Multiplying Exponents (A)

Simplify each expression.

1. $5^{-5} \cdot (-2)^{-5}$

2. $(-3)^{-2} \cdot (-9)^{-2}$

3. $4^{-8} \cdot 8^{-8}$

4. $2^{-1} \cdot 8^{-1}$

5. $3^{7} \cdot (-7)^{7}$

6. $(-7)^{-2} \cdot (-5)^{-2}$

7. $7^{3} \cdot (-6)^{3}$

8. $6^{5} \cdot 9^{5}$

9. $(-9)^{-9} \cdot 4^{-9}$

10. $(-4)^{-9} \cdot 8^{-9}$

Exponents, Roots and Logarithms

Exponents, Roots (such as square roots, cube roots etc) and Logarithms are all related!

Let's start with the simple example of **3 × 3 = 9**:

3 Squared = = 3 × 3 = **9**

Using Exponents we write it as:

$$3^2 = 9$$

When any of those values are missing, we have a question. And (sadly) a **different notation**:

$3^2 = ?$

is the exponent question "what is 3 squared?": $3^2 = 9$

$?^2 = 9$

is the root question "what is the square root of 9?": $\sqrt{9} = 3$

$3^? = 9$

is the logarithm question "what is log base 3 of 9?": $\log_3(9) = 2$

So when you are stuck trying to solve questions with logs, roots or exponents just remember that!

One more example:

$$10^3 = 1000$$

$10^3 = ?$

"What is 10 cubed?": $10^3 = 1000$

$?^3 = 1000$

"What is the cube root of 1000?": $\sqrt[3]{1000} = 10$

$10^? = 1000$

"What is log base 10 of 1000?": $\log_{10}(1000) = 3$

Squares and Square Roots (A)

Instructions: Find the square root or square of each integer.

$\sqrt{256} =$	$\sqrt{4} =$	$\sqrt{169} =$	$\sqrt{100} =$
$\sqrt{121} =$	$\sqrt{196} =$	$\sqrt{16} =$	$\sqrt{64} =$
$\sqrt{1} =$	$\sqrt{9} =$	$\sqrt{49} =$	$\sqrt{144} =$
$\sqrt{225} =$	$\sqrt{81} =$	$\sqrt{25} =$	$\sqrt{36} =$
$11^2 =$	$13^2 =$	$14^2 =$	$10^2 =$
$12^2 =$	$1^2 =$	$15^2 =$	$6^2 =$
$9^2 =$	$3^2 =$	$4^2 =$	$16^2 =$
$8^2 =$	$7^2 =$	$5^2 =$	$2^2 =$