**O level Mathematics by Anon**

**Indices**

We can represent $7×7×7×7$ as$ 7^{4}$.

Similarly we say $7^{3}$ is$ 7×7×7$.

Note: Any number which has an index of zero is 1 e.g. ($4^{0}=1$)

**What are they called?**

 Index (plural indices)

 Base

$7^{5}$

We can say the above number as “ 7 raised to the power 5”, or to be general, we say $a^{n}$ to be“ a to the power n”

**Multiplication Law of Indices:**

When two numerical with the same base multiply, their powers are added:

Example: $a^{2}×a^{3}=a^{5}$ (2 + 3 = 5)

Proof: $7^{4}×7^{3}=\left(7×7×7×7\right)×\left(7×7×7\right)=7×7×7×7×7×7×7=7^{7}$

In general we can say that:

$$a^{m}×a^{n}= a^{m+n}$$

**Division Law of Indices:**

When two numerical with same base divide, their power is subtracted

Example: $a^{5}÷ a^{3}= a^{2}$ (5 – 3 = 2)

Proof: $7^{8}÷7^{5}= \frac{7×7×7×7×7×7×7×7}{7×7×7×7×7}=7×7×7=7^{3}$

So in general we can say that:

$$a^{m}÷a^{n}=a^{m-n}$$

**Power law of Indices:**

When a numerical is multiplied by a power, the existing and multiplying power multiply while base remains the same.

Example:$(a^{4})^{3}= a^{12}$ $(4×3=12)$

Proof: $(6^{2})^{3}=\left(6×6\right)×\left(6×6\right)×\left(6×6\right)=6×6×6×6×6×6=6^{6}$

In general we can say that:

$$(a^{m})^{n}=a^{mn}$$

**Other Laws of Indices:**

When two numerical with different bases but same power divide or multiply, the bases can multiply or divide taking the power as whole.

Example: $a^{5}×b^{5}=(a×b)^{5}$

Similarly: $a^{5}÷b^{5}=\left[\frac{a}{b}\right]^{5}$

Proof: $6^{4}×2^{4}=\left(6×2\right)^{4}=12^{4}=20736$

While: $6^{4}×2^{4}=\left(1296\right)×\left(16\right)=20736$

So in general we can say that:

$$a^{n}×b^{n}=(a×b)^{n}$$