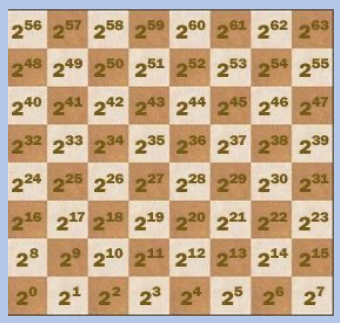
UNIT 2. POWERS AND ROOTS (3º ESO)

THE RICE AND THE CHESS BOARD STORY – THE POWER OF EXPONENTIAL GROWTH

There was once a **king** in India who was a big chess enthusiast and had the habit of challenging wise visitors to a game of chess. One day a traveling **sage** was challenged by the king. The sage having played this game all his life gladly accepted the Kings challenge. To motivate his opponent the king offered **any reward that the sage could name**. The sage modestly asked just for a few grains of rice in the following manner: the king was to **put a single grain of rice on the first chess square and double it on every consequent one**. The king accepted the sage's request.

Having lost the game and being a man of his word the king ordered a bag of rice to be brought to the chess board. Then he started placing rice grains according to the arrangement: **1 grain on the first square, 2 on the second, 4 on the third, 8 on the fourth and so on**.

Following the exponential growth of the rice payment, the king quickly realized that he was unable to fulfill his promise because on the on the **64th square, the king would have had to put more than 18,000,000,000,000,000,000 grains of rice which is equal to about 210 billion tons** and is allegedly sufficient to cover the whole territory of India with a meterthick layer of rice.



It was at that point that the sage told the king that he doesn't have to pay the debt immediately but can do so over time. And so the sage became the **wealthiest person in the world.**

HOW APPEARED THE ROOT SYMBOL?

The root symbol was first used in 1525 by the mathematician Christoph Rudolff. Previously, "root of …" was written to indicate the root of a number. Then, in short, he started to put "r". But if the number was long, the horizontal line of the "r" would lengthen until it covered all the figures.

In that way, the symbol of the root was born, like a badly made "r"

VOCABULARY & EXPRESSIONS

Power: potencia

Base: base

Exponent: exponente

a elevado a b: a to the power of b

El cuadrado de …: The square of…

El cubo de…: The cube of …

Scientific notation: notación científica

Large numbers: nºs grandes

Small numbers: nºs pequeños

Orden de magnitud: order of magnitude

Root: raíz

Radicand: radicando

Square root: raíz cuadrada

Irrational numbers: nºs irracionales

Rational numbers: nºs racionales

Real numbers: números reales

Truncation: truncamiento

Rounding off: redondeo

Cifras significativas: significant figures

Error absoluto: absolute error

Error relativo: relative error

Interval: intervalo

Closed interval: intervalo cerrado

Open interval: intervalo abierto

Half-open interval: intervalo semiabierto

CAN YOU GUESS THE INTERVAL?

Using intervals we can represent different situations and they tell us which numbers are in each option that we imagine. So, we write the beginning and ending numbers of the interval. If the end value is included we have to write a square bracket, but if the end is not included we have to write a bracket.

Now, we are going to work with them like conditions.

"You can go to the disco if you have 18 years old or more" → $[18, +\infty)$

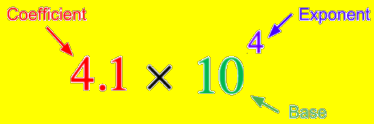
"Cartoons are recommended for children between 2 and 13 years old" → $(2,13)$

Now, imagine some situations with the students and represent them!

SCIENTIFIC NOTATION

The scientific notation is a way of expressing very small and very large numbers. If the number is very large the exponent will be positive. However, if the number is very smal the exponent will be negative.

Here, you have some real examples. You can practise with the students how to write them into scientific notation.



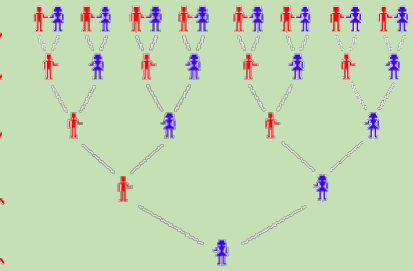
Distance from Earth to the Sun – 150000000 km = $1{,}5 \cdot 10^{8}$ km

Flu virus diameter – 0,0000001 m = $1 \cdot 10^{-7}$ m

CO_2 emisions in one year – 54900000000 kg = $5{,}49 \cdot 10^{10}$ kg

The weight of a grain of rice – 0,0000000027 g = $2{,}7 \cdot 10^{-9}$ g

MY FAMILY TREE



Imagine that you want to know how many Great Grandparents you have.

You have 2 parents, so $2 = 2^1$

Each one has two parents, your Grandparents, so $2 \cdot 2 = 2^2 = 4$

Each grandparent has two parents, your Great Grandparents, so $4 \cdot 2 = 2 \cdot 2 \cdot 2 = 2^3 = 8$ →This way, you have 8 Great Grandparents.

Try to find how many Great-Great-Great Grandparents you have.