

## SCIENTIFIC NOTATION

### Convert to Scientific Notation

Move the decimal point until there is one digit to the left of the decimal point.

Exponent goes **up** ← Decimal point moves **left** • Decimal point moves **right** → Exponent goes **down**

Examples:

$$156000. = 1.56 \times 10^5$$

Move decimal point 5 places left, exponent goes up by 5

$$0.0000053 = 5.3 \times 10^{-6}$$

Move decimal point 6 places right, exponent goes down by 6

## Earth and the Sun



- Light travels at approximately  $3.0 \cdot 10^5$  km per second. The light from the sun takes approximately 500 seconds to reach Earth. Approximately how many kilometers apart are the sun and Earth?
- **Step 1:** Write both numbers in scientific notation.
  - $3.0 \cdot 10^5$  &  $5 \cdot 10^2$
- **Step 2:** Multiply numbers
  - $3(5) = 15$
- **Step 3:** Add exponents
  - $10^5 \cdot 10^2 \gg (5 + 2 = 7) \gg 10^7$
- **Step 4:** Write in proper scientific notation.
  - $15 \cdot 10^7 = 1.5 \cdot 10^8$  km



## VOCABULARY & EXPRESSIONS

- POWER:** potencia
- Base:** base
- Exponent:** exponente

$$a^b$$

← EXPONENT  
↑ BASE

- **A squared:** al cuadrado
- **A cube:** al cubo
- **Properties:** propiedades

- ROOT:** raíz
- Square root:** raíz cuadrada
- Exact square root:** raíz cuadrada exacta
- Integer square root:** raíz cuadrada entera (no exacta)
- **Remainder:** resto
- **Radicand:** radicando

$$\sqrt{a} = b$$

↑ ROOT  
↑ RADICAND

## TRUE OR FALSE?

- To raise a number to the cube is the same as multiplying it by itself three times.
- To raise a number to the power of four is like multiplying it by four.
- The square of 10 is 20.
- The cube of 10 is 1 000.
- Thirteen to the power of five is equal to five to the power of thirteen.

## POWERS

Powers are a shortened form of writing a number that is multiplied by itself many times:

$$a^b = a \cdot a \cdot a \cdot \dots \cdot a \quad (b \text{ times})$$

$$6^3 = 6 \cdot 6 \cdot 6 = 216$$

In words we say: **a to the power of b or a raised to the b<sup>th</sup> power**

Doing examples:

$4^2 \rightarrow$  four to the power of two

Five raised to the third power  $\rightarrow 5^3$

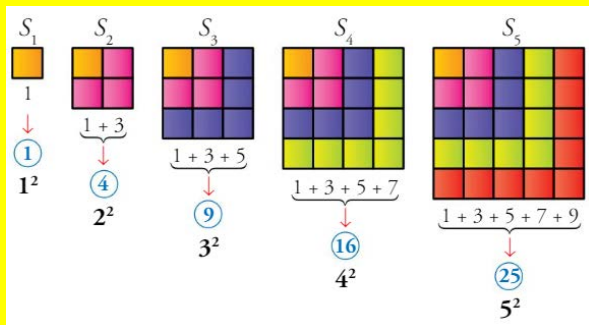
**Invent more examples!**

In English, the words 'base' and 'exponent' are very similar to the words in Spanish. For example, in  $2^5$ , 2 is the base (base) and 5 is the exponent (exponente). However, when you read a maths power out loud in English you should say '2 to the power of 5'. There are two special cases:  $a^2$  is read 'a squared', and  $a^3$  is read 'a cubed'.

## ADDING ODD NUMBERS

Look at the following Pythagorean relationship:

We can express any square number ( $2^2 = 4$ ,  $3^2 = 9$ ,  $4^2 = 16$  .....) as the result of **ADDING** some of the first odd numbers:



Try yourself:

- The sum of adding the first seven odd numbers
- The sum of adding the first nine odd numbers

## POWERS WITH SCIENTIFIC CALCULATOR

With scientific calculators, we use the  $x^y$  key.

$$9^6 \rightarrow 9 \ x^y \ 6 \ = \rightarrow \boxed{531441}$$

NOTE: When the result is too big and does not fit on the screen, simple calculators give an error as result, while scientific calculators give a result in formats such as the following:

$$45^8 \rightarrow \boxed{1.681512539 \times 10^{13}}$$

which means that the decimal number on the screen must be multiplied 13 times by 10 (i.e. move the decimal point 13 places to the right).



$$R = \frac{a}{2 \sin \alpha}$$