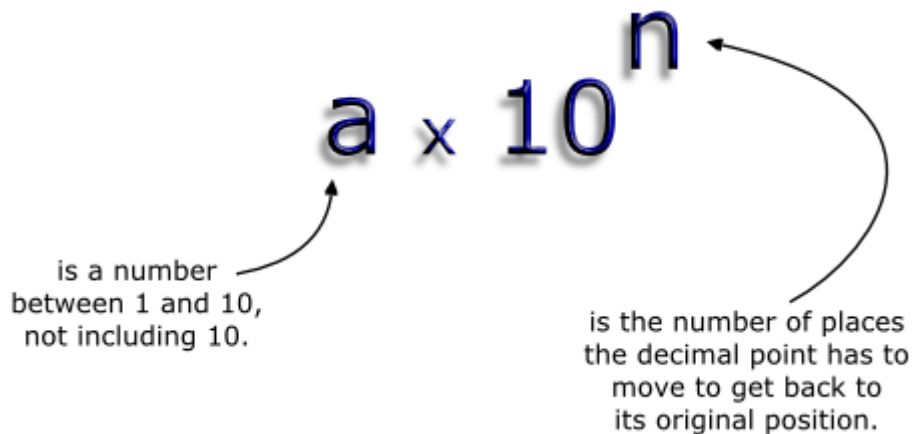


## STANDARD FORM

- Standard Form is used to write very large numbers or very small numbers in a simpler way.
- Calculators and Computers use standard form automatically to display very large and very small numbers.
- When written in standard form, the number will be written as:



- **Learn these rules**
  - The front number, **a**, must always be between **1** and **10**.
  - The power of 10, **n**, tells you how far the decimal point moves.
  - If the number is **big**, **n** is positive.
  - If the number is **small**, **n** is negative.

**EXAMPLES****BIG NUMBERS**

1. Write 576000 in standard form.
  - Move the decimal point to between the 5 and 7 to give 5.76000  
( $1 \leq 5.76 < 10$ )
  - Count how many places the decimal point needs to be moved back to return the number to its original form

# 5.76000

In this case 5 places.

- In standard form,  $576000 = 5.76 \times 10^5$ .
2. Write 34890000 in standard form
    - Move the decimal point to between the 3 and 4 to give 3.4890000  
( $1 \leq 3.489 < 10$ )
    - Count how many places the decimal point needs to be moved back to return the number to its original form

In this case 7 places. **34890000**

- In standard form,  $34890000 = 3.489 \times 10^7$ .
3.  $567 = 5.57 \times 10^2$  in standard form.

**SMALL NUMBERS**

1. Write 0.00456 in standard form.
  - Move the decimal point to between the 4 and 5 to give 4.56000 ( $1 \leq 4.56 < 10$ )
  - Count how many places the decimal point needs to be moved back to return the number to its original form

○

0004.56

- In this case 3 places.
- In standard form,  $0.00456 = 4.56 \times 10^{-3}$ .  
(The  $-3$  means that the decimal place needs to be moved 3 places left)

2.  $0.0000345 = 3.45 \times 10^{-5}$  in standard form.

**MULTIPLYING AND DIVIDING**

- The laws of indices are used when multiplying or dividing numbers written in standard form.

$$a^m \times a^n = a^{m+n} \quad \text{example: } a^3 \times a^4 = a^8$$

$$a^m \div a^n = a^{m-n} \quad \text{example: } a^5 \div a^2 = a^3$$

**EXAMPLES**

$$\begin{aligned} 1. \quad (4.0 \times 10^2) \times (2.0 \times 10^3) &= 4.0 \times 10^2 \times 2.0 \times 10^3 \\ &= 4.0 \times 2.0 \times 10^2 \times 10^3 \\ &= 8 \times 10^5 \end{aligned}$$

$$\begin{aligned} 2. \quad (5.5 \times 10^3) \times (2.0 \times 10^4) &= 5.5 \times 2.0 \times 10^3 \times 10^4 \\ &= 11.0 \times 10^7 \\ &= 1.1 \times 10^1 \times 10^7 \\ &= 1.1 \times 10^8 \end{aligned}$$

$$\begin{aligned} 3. \quad (4.0 \times 10^5) \div (2.0 \times 10^2) &= \frac{4.0}{2.0} \times \frac{10^5}{10^2} \\ &= 2.0 \times 10^3 \end{aligned}$$

$$\begin{aligned} 4. \quad (2.4 \times 10^{-2}) \div (3.0 \times 10^4) &= \frac{2.4}{3.0} \times \frac{10^{-2}}{10^4} \\ &= 0.8 \times 10^{-6} \\ &= 8.0 \times 10^{-1} \times 10^{-6} \\ &= 8.0 \times 10^{-7} \end{aligned}$$

**ADDING AND SUBTRACTING**

- One way of adding and subtracting numbers written in standard form is to write them in decimal form, add or subtract and then write the answer in standard form.

**EXAMPLES**

$$\begin{aligned}1. \quad (2.5 \times 10^2) + (3.25 \times 10^3) &= 250 + 3250 \\ &= 3500 \\ &= 3.5 \times 10^3\end{aligned}$$

$$\begin{aligned}2. \quad (5.25 \times 10^4) - (1.05 \times 10^3) &= 52500 - 1050 \\ &= 51450 \\ &= 5.145 \times 10^4\end{aligned}$$

- Another way is to factorise.

**EXAMPLE**

$$\begin{aligned}1. \quad (2.5 \times 10^2) + (3.25 \times 10^3) &= 2.5 \times 10^2 + 3.25 \times 10^3 \\ &= 10^2 (2.5 + 3.25 \times 10^1) \\ &= 10^2 (2.5 + 32.5) \\ &= 10^2 (35.0) \\ &= 10^2 (3.5 \times 10^1) \\ &= 3.5 \times 10^3\end{aligned}$$

## USING A CALCULATOR

- Most scientific calculators will automatically display very large and very small numbers in standard form.
- [Some calculators can be set to Standard Form mode](#). This can be very useful when doing standard form questions. Look in your manual to find out how.
- Be careful to write your answer in the form asked for.
- Make sure that you know how to use your calculator and you can find the standard form key. Here is the standard form key for one make of calculator.



### CALCULATIONS WITH STANDARD FORM

- Use your calculator to do complicated calculations in standard form.
- If your calculator cannot accept large numbers, write that number in standard form first.

#### Examples

$$1. (5.57 \times 10^2) \times (2.43 \times 10^{21}) = 1.35351 \times 10^{24}.$$

$$2. (5.57 \times 10^{-5}) \div (2.43 \times 10^{12}) = 2.29 \times 10^{-17} \text{ (2 d.p.)}$$

$$3. 237\,000\,000\,000 \times 344\,000\,000 = 2.37 \times 10^{11} \times 3.45 \times 10^8 = 8.18 \times 10^{19}$$

$$4. \frac{2.34 \times 10^{-3} + 4.2 \times 10^{-2}}{1.8 \times 10^3} = 2.463 \times 10^{-5}$$

$$5. \frac{0.00000765 \times 0.00000056}{538000} = \frac{7.65 \times 10^{-6} \times 5.6 \times 10^{-7}}{5.38 \times 10^5} \\ = 7.96 \times 10^{-18}$$