Mathematics

Standard Form

Converting to & from Standard Form

$$a \times 10^{n}$$

What is standard form and why is it used?

- **Standard form** is a way of writing **very large** and **very small numbers** using **powers of 10**
- This allows us to:
  - Write them more concisely
  - Compare them more easily
  - Perform calculations with them more easily

Source: https://www.savemyexams.com

How do I write a number in standard form?

- Numbers written in standard form are always written as:

$$a \times 10^n$$

- Where:
  - $1 \leq a < 10$ (a is **between 1 and 10**)
  - $n > 0$ (n is **positive**) for **large** numbers
  - $n < 0$ (n is **negative**) for **small** numbers

How do I write a large number in standard form?

- To write a **large number** such as 3 240 000 in standard form
  - Identify the value of a
    - 3.24
  - Find **how many times** you must **multiply** 3.24 **by 10**, to make 3 240 000
    - Count how many places you need to move the decimal point
    - We need to multiply by 10 six times
  - $3\,240\,000 = 3.24 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = \mathbf{3.24 \times 10^6}$

How do I write a large number in standard form?

- To write a **large number** such as 3 240 000 in standard form
  - Identify the value of a
    - 3.24
  - Find **how many times** you must **multiply** 3.24 **by 10**, to make 3 240 000
    - Count how many places you need to move the decimal point
    - We need to multiply by 10 six times
  - $3\,240\,000 = 3.24 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = \mathbf{3.24 \times 10^6}$

How do I write a small number in standard form?

- To write a **small number** such as 0.000567 in standard form
  - Identify the value of a
    - 5.67
  - Find **how many times** you must **divide** 5.67 **by 10**, to make 0.000567
    - Count how many places you need to move the decimal point
    - We need to divide by 10 four times
    - We are dividing rather than multiplying so the **power will be negative**
  - $0.000567 = 5.67 \div 10 \div 10 \div 10 \div 10 = \mathbf{5.67 \times 10^{-4}}$

How do I write a small number in standard form?

- To write a **small number** such as 0.000567 in standard form
  - Identify the value of a
    - 5.67
  - Find **how many times** you must **divide** 5.67 **by 10**, to make 0.000567
    - Count how many places you need to move the decimal point
    - We need to divide by 10 four times
    - We are dividing rather than multiplying so the **power will be negative**
  - $0.000567 = 5.67 \div 10 \div 10 \div 10 \div 10 = \mathbf{5.67 \times 10^{-4}}$

Worked Example

(a) Without a calculator, write 0.007052 in standard form.

Standard form will be written as $a \times 10^n$ where a is between 1 and 10
Find the value for a

$$a = 7.052$$

The original number is smaller than 1 so n will be negative
Count how many times you need to divide a by 10 to get the original number

$$0.007052 = 7.052 \div 10 \div 10 \div 10 \text{ (3 times)}$$

Therefore $n = -3$.

Worked Example

(a) Without a calculator, write 0.007052 in standard form.

Standard form will be written as $a \times 10^n$ where a is between 1 and 10
Find the value for a

$$a = 7.052$$

The original number is smaller than 1 so n will be negative
Count how many times you need to divide a by 10 to get the original number

$$0.007052 = 7.052 \div 10 \div 10 \div 10 \text{ (3 times)}$$

Therefore $n = -3$.

$$0.007052 = 7.052 \times 10^{-3}$$

Worked Example

(b) Without a calculator, write 324 500 000 in standard form.

Standard form will be written as $a \times 10^n$ where a is between 1 and 10
Find the value for a

$$a = 3.245$$

The original number is larger than 1 so n will be positive
Count how many times you need to multiply a by 10 to get the original number

$$324\,500\,000 = 3.245 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \text{ (8 times)}$$

Therefore $n = 8$

Worked Example

(b) Without a calculator, write 324 500 000 in standard form.

Standard form will be written as $a \times 10^n$ where a is between 1 and 10
Find the value for a

$$a = 3.245$$

The original number is larger than 1 so n will be positive
Count how many times you need to multiply a by 10 to get the original number

$$324\,500\,000 = 3.245 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \text{ (8 times)}$$

Therefore $n = 8$

$$\mathbf{324\,500\,000 = 3.245 \times 10^8}$$

Thank you!

EXCEL SCIENCE

www.YouTube.com/@EXCEL_SCIENCE