IGCSE Mathematics – Standard (index) form

Standard form (or ‘standard index form’) is only really useful for writing VERY BIG or VERY SMALL numbers in a more convenient way, e.g.

56 000 000 000 would be $5.6 \times 10^{10}$ in standard form.

0.000 000 003 45 would be $3.45 \times 10^{-9}$ in standard form.

ANY NUMBER can be written in standard form

A number written in standard form must ALWAYS be in EXACTLY this form:

$$A \times 10^n$$

This number must always be BETWEEN 1 AND 10.

This number is just the NUMBER OF PLACES the Decimal Point moves.

1) The front number must always be BETWEEN 1 AND 10.
2) The power of 10, $n$, is purely: HOW FAR THE D.P. MOVES.
3) $n$ is + for BIG numbers, $n$ is – for SMALL numbers.

A positive index

$100 = 1 \times 10^2$
$1000 = 1 \times 10^3$
$10 000 = 1 \times 10^4$
$3000 = 3 \times 10^3$

For a number to be in standard form it must take the form

$A \times 10^n$ where the index $n$ is a positive or negative integer and

$A$ must lie in the range $1 \leq A < 10$.

e.g. 3100 can be written in many different ways:

$31 \times 10^2$, $3.1 \times 10^3$, $0.31 \times 10^4$ etc.

However, only $3.1 \times 10^3$ satisfies the above conditions and therefore is the only one which is written in standard form.

A negative index

A negative index is used when writing a number between 0 and 1 in standard form.

e.g. $100 = 1 \times 10^2$
$10 = 1 \times 10^1$
$1 = 1 \times 10^0$
$0.1 = 1 \times 10^{-1}$
$0.01 = 1 \times 10^{-2}$
$0.001 = 1 \times 10^{-3}$
$0.0001 = 1 \times 10^{-4}$

Note that $A$ must still lie within the range $1 \leq A < 10$.

Examples

1) "Express 35 600 in standard form."

**METHOD:**
1) Move the D.P. until 35 600 becomes 3.56 (1 ≤ $A < 10$)
2) The D.P. has moved 4 places so $n=4$, giving: $10^4$
3) 35 600 is a BIG number so $n$ is +4, not –4

**ANSWER:**

$3.56 \times 10^4$

2) "Express 0.0000623 in standard form."

**METHOD:**
1) The D.P. must move 5 places to give 6.23 (1 ≤ $A < 10$),
2) So the power of 10 is 5
3) Since 0.0000623 is a SMALL NUMBER it must be $10^{-5}$ not $10^{+5}$.

**ANSWER:**

$6.23 \times 10^{-5}$