

GCSE MATHS

Standard form

Long workbook

Questions on GCSE Maths topics, including challenges beyond typical exam questions.

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Topic recap

Standard form

A number in standard form is $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

Products and quotients

Multiply or divide the coefficients; add or subtract the powers. Then put the coefficient back between 1 and 10.

Sums and differences

First use a common power: $3 \times 10^5 + 4 \times 10^4 = (3 + 0.4) \times 10^5$.

Units

Match the units before comparing quantities or dividing.

Try the calculations without a calculator, then use one to check your answers.

1. Writing and interpreting standard form

Example Problem 1

★

Write 0.00084 in standard form.

The idea

1. Make the coefficient at least 1 and less than 10.

Worked Solution

$$0.00084 = 8.4 \div 10000$$

$$= 8.4 \times 10^{-4}$$

Move four places to obtain the coefficient 8.4.

The division gives a negative power.

1 Writing and interpreting standard form********Q1** Write 6,500,000 in standard form.*******Q2** Write 0.000072 in standard form.*******Q3** Write 903,000,000 in standard form.*******Q4** Write 4.06×10^{-3} as an ordinary decimal.*******Q5** Rewrite 38×10^5 in standard form.********Q6** Write 0.0062 in standard form.*****

2. Multiplying and dividing

Example Problem 2

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Calculate $(6 \times 10^7)(5 \times 10^{-3})$ in standard form.

The idea

1. Work with the coefficients and powers separately.

Worked Solution

$$6(5) \times 10^{7-3} = 30 \times 10^4$$

$$= 3 \times 10^5$$

Multiply coefficients and add indices.

Divide the coefficient by ten and increase the index.

2 Multiplying and dividing

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Q7 Calculate $(3 \times 10^4)(2 \times 10^5)$. Give your answer in standard form.

**

Q8 Calculate $(8 \times 10^6)(4 \times 10^{-3})$. Give your answer in standard form.

**

Q9 Calculate $\frac{9 \times 10^8}{3 \times 10^2}$. Give your answer in standard form.

**

Q10 Calculate $\frac{4.8 \times 10^{-3}}{6 \times 10^2}$. Give your answer in standard form.

**

Q11 Calculate $(5 \times 10^{-4})^2$. Give your answer in standard form.

**

Q12 Calculate $\frac{(6 \times 10^5)(4 \times 10^{-2})}{3 \times 10^3}$. Give your answer in standard form.

**

3. Adding, subtracting and comparing

Example Problem 3

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Calculate $2 \times 10^5 + 7 \times 10^4$ in standard form.

The idea

1. Only combine coefficients after matching the powers.

Worked Solution

$$7 \times 10^4 = 0.7 \times 10^5$$

Match powers of ten.

$$(2 + 0.7) \times 10^5 = 2.7 \times 10^5$$

Add coefficients.

3 Adding, subtracting and comparing

Q13 Calculate $3.2 \times 10^6 + 4.5 \times 10^5$ in standard form.

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Q14 Calculate $7 \times 10^{-3} - 2.5 \times 10^{-4}$ in standard form.

**

Q15 Calculate $8 \times 10^7 + 6 \times 10^7$ in standard form.

**

Q16 Put these in increasing order: 4×10^{-3} , 7×10^{-4} , 2×10^{-2} .

**

Q17 Find the ratio of 6×10^8 to 1.5×10^6 in the form $n : 1$.

Q18 Find the positive integer n such that $2 \times 10^n + 3 \times 10^{n-1} = 230,000$.

4. Problems with very large and small quantities

Example Problem 4

A particle has mass 4×10^{-9} g. Find the mass of 3×10^6 particles in grams.

The idea

1. Keep the given mass unit through the calculation.

Worked Solution

$$m = (4 \times 10^{-9})(3 \times 10^6)$$

Multiply one mass by the count.

$$m = 12 \times 10^{-3} = 1.2 \times 10^{-2} \text{ g}$$

Write the answer in standard form.

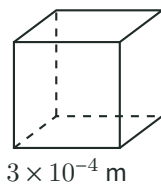
4 Problems with very large and small quantities

Q19 A bacterium is 2.5×10^{-6} m long. How many laid end to end make 1 metre?

Q20 A file contains 6×10^8 bytes. A connection transfers 2.4×10^6 bytes per second. Find the transfer time.

Q21 One sheet is 8×10^{-2} mm thick. Find the height in metres of 2.5×10^4 sheets.

Q22 A cube has side 3×10^{-4} m. Find its volume in standard form.



Q23 A population rises from 4×10^6 to 5.2×10^6 . Find the percentage increase.

Q24 $A = 3 \times 10^n$ and $B = 2 \times 10^{n+2}$. Given $AB = 6 \times 10^{12}$: (a) find n ; (b) give $A + B$ in standard form.

Solving principles

1. Estimate the size

Check whether the answer should grow or shrink.

2. Adjust the coefficient at the end

Moving the decimal point changes the required power of ten.

3. Use a common power for sums

Add quantities, not indices.

4. Keep units visible

Convert before forming a ratio, rate or count.