Year 9 Standard Form and Bounds – Revision Notes

HappyKids.fit

Year 9 · Maths · Standard Form, Powers of Ten and Bounds · Key ideas and worked examples

For grown-ups and learners: read each part and try the worked example. Then work through the sheets: Foundation, Developing, Challenge, then Mixed Practice to revise everything. Show your working: it earns marks in tests and helps you spot mistakes.

1. Multiplying and dividing by powers of 10

$10^3 = 1000$ and $10^{-3} = 1/1000$. So **$\times 10^3$** moves the digits 3 places left (bigger) and **$\times 10^{-3}$** is the same as **$\div$ 1000**: $4.7 \times 10^3 = 4700$ and $4.7 \times 10^{-3} = 0.0047$. Dividing by a negative power of 10 makes a number **bigger**: $0.36 \div 10^{-2} = 0.36 \times 100 = 36$.

Example: Work out $3.31 \div 10^3$.
→ $\div 10^3$ means divide by 1000
→ = 0.00331
Answer: 0.00331

2. Standard form

A number in **standard form** is written as **$A \times 10^n$**, where $1 \leq A < 10$ and n is an integer. Large numbers have a positive index: 45 600 000 = **4.56×10^7**. Small numbers have a negative index: 0.000 307 = **3.07×10^{-4}**. To compare numbers in standard form, look at the powers of 10 first, then the numbers in front.

Example: Write 9 600 000 000 in standard form.
→ Put the decimal point after the first non-zero digit: 9.6
→ 9 600 000 000 = 9.6×10^9
Answer: 9.6×10^9

3. Calculating in standard form

To **multiply**, multiply the numbers and add the indices: $(3 \times 10^4) \times (4 \times 10^{-7}) = 12 \times 10^{-3} =$ **1.2×10^{-2}**. To **divide**, divide the numbers and subtract the indices. To **add or subtract**, first write both numbers with the same power of 10. Always check that the answer is in standard form.

Example: Work out $(2 \times 10^{-2}) \times (3.5 \times 10^{-5})$. Give your answer in standard form.
→ $2 \times 3.5 = 7$ and $10^{-2} \times 10^{-5} = 10^{-7}$
→ = 7×10^{-7}
Answer: 7×10^{-7}

4. Upper and lower bounds

A rounded number could have come from a range of values. If a length is **8 cm to the nearest cm**, the true length is at least **7.5 cm** (the **lower bound**) and less than **8.5 cm** (the **upper bound**). Write this as the error interval $7.5 \leq x < 8.5$. The bounds are half a unit of rounding either side: for 2.4 kg to 1 decimal place they are 2.35 kg and 2.45 kg.

Example: A cycle race is 120 m, correct to the nearest 10. Write down the lower and upper bounds.
→ Half of 10 is 5
→ Lower: 120 − 5 = 115; upper: 120 + 5 = 125
Answer: lower bound 115 m, upper bound 125 m

Think like a mathematician: test a few cases (**specialising**), look for the rule that always works (**generalising**), and explain why you are sure (**convincing**). When you check someone's working, say what is wrong and how to **improve** it.

Common mistakes: writing 45×10^3 (the number in front must be less than 10). Using a positive index for a small number. Multiplying the indices when you multiply numbers in standard form. Thinking the upper bound of 8 cm is 8.4 cm.