1.8 Rounding, bounds, estimation and standard form

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS upper bound • standard form

Rounding, bounds, estimation and standard form

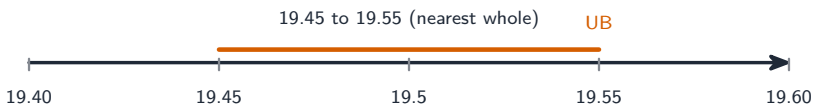
Objective

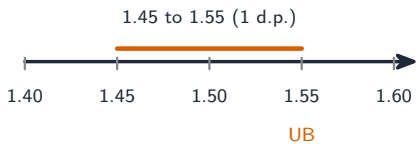
Round to powers of ten, significant figures and decimal places; identify and use upper and lower bounds, estimate by 1 s.f., and calculate with standard form (objectives Foundation 1.8 A–D, 1.9 A, 1.10 A–C, 1.11 A and Higher 1.8 A, 1.9 A).

1 Key knowledge and worked examples

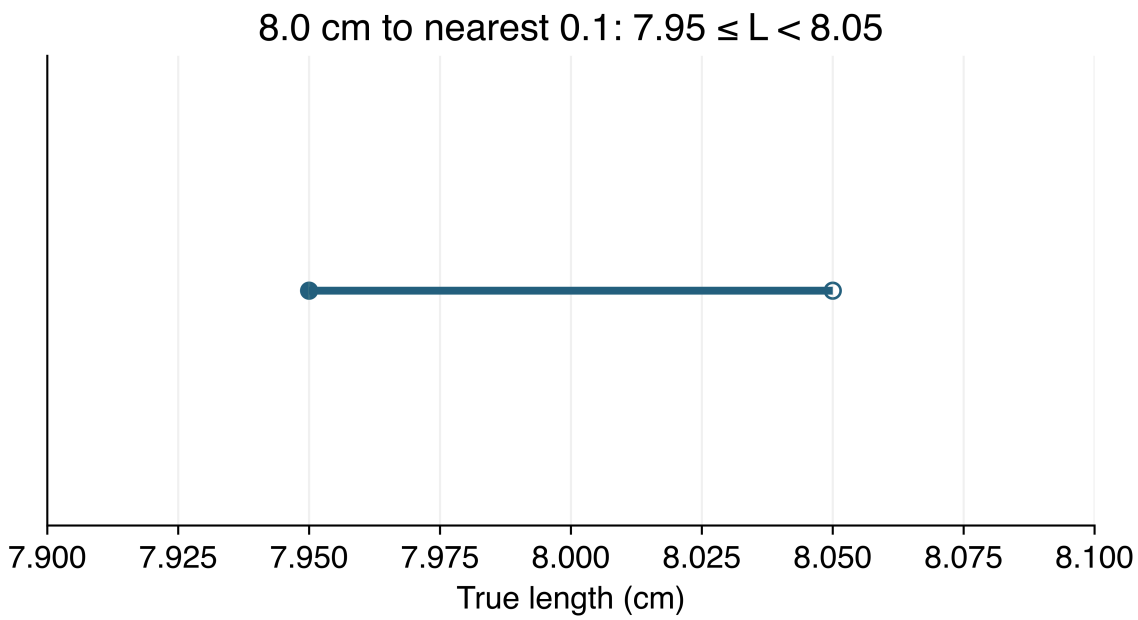
Accuracy. $3.4617 \to 3.5$ (2 s.f.) and 3.46 (2 d.p.). A value to the nearest unit u lies between $v - \frac{u}{2}$ and $v + \frac{u}{2}$: 19.5 to the nearest whole spans 19.45 to 19.55. Estimation rounds to 1 s.f.: $\frac{4.12 \times 29.8}{0.187} \approx \frac{4 \times 30}{0.2} = 600$.

Bounds problems and standard form. Choose the extremes the question needs – June 2024 2HR Q19: speed UB 19.5, time UB 1.55, so the distance UB is $19.5 \times 1.55 = 30.2$ km (3 s.f.). Standard form $a \times 10^n$, $1 \leq a < 10$: $604000 = 6.04 \times 10^5$, $0.00007 = 7 \times 10^{-5}$ (June 2024 2HR Q9).





maximise distance: UB speed $\times$ UB time
$= \ 19.5 \times 1.55 \ = \ 30.2$ km (3 s.f.)



Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 Round 3.4617 to 2 significant figures and to 2 decimal places. [2]

2.2 A length is 250 m correct to the nearest 10 m. Write down the upper and lower bounds. [2]

2.3 Estimate $\dfrac{4.12 \times 29.8}{0.187}$ [3]

2.4 Write 604000 in standard form [1]

2.5 Write 0.00007 in standard form [1]

3 Exam-style questions

3.1 *(Edexcel 4MA1 2HR June 2024 Q19, adapted.)* Aviv cycles with average speed 19 km/h correct to the nearest whole number, for 1.5 hours correct to one decimal place. Work out the upper bound for the distance travelled, to 3 significant figures. [3]

3.2 *(Edexcel 4MA1 2HR June 2024 Q9 family, adapted.)* (a) Write 604000 in standard form. (b) Write 0.00007 in standard form. (c) Work out $(3 \times 10^4) \times (2 \times 10^6)$, giving the answer in standard form. [4]

3.3 *(Original.)* A rectangular room is 4.2 m by 3.6 m, each to the nearest 0.1 m. (a) Write the bounds of each length. (b) Work out the upper bound of the area. (c) Why does the lower bound of the area multiply the two lower bounds? [4]

Solutions

2.1 3.5; 3.46.

2.2 LB 245 m; UB 255 m.

2.3 $\frac{4\times30}{0.2} = 600$.

2.4 6.04×10^5.

2.5 7×10^{-5}.

3.1 Speed UB 19.5; time UB 1.55: $19.5 \times 1.55 = 30.225 = 30.2$ km (3 s.f.).

3.2 (a) 6.04×10^5. (b) 7×10^{-5}. (c) $3 \times 2 = 6$ and $10^4 \times 10^6 = 10^{10}$: 6×10^{10}.

3.3 (a) 4.2 m spans 4.15–4.25; 3.6 m spans 3.55–3.65. (b) $4.25 \times 3.65 = 15.5125$ m^2. (c) Both factors are positive, so the product is smallest when each factor takes its lower bound: 4.15×3.55.

Local review guidance: bounds written before combining; answers to the accuracy asked; bound problems justify WHICH extreme each part needs. This is authored classroom guidance.