

Exercise walk-through

Limits of accuracy ■ E1.10

eXercise

You must be able to

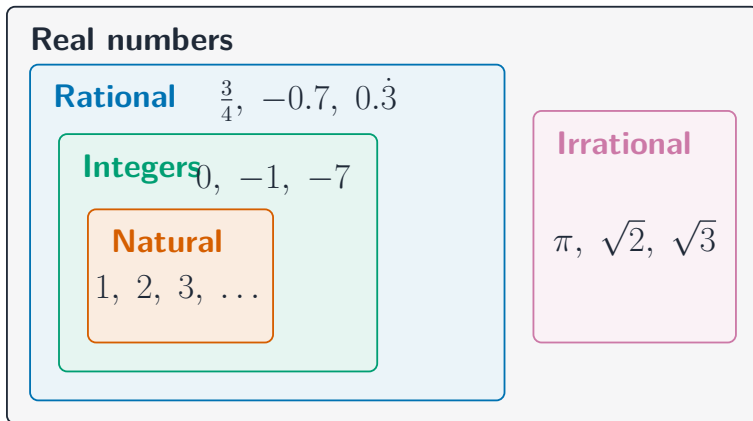
- give the upper and lower bounds of a rounded measurement
- find the largest and smallest result of a calculation
- choose the right bounds for a sum, product or quotient

Method — Upper and lower bounds

- **Bounds:** 635 m to the nearest metre $\rightarrow 634.5 \leq h < 635.5$.
- **Largest product:** use both **upper** bounds. **Smallest:** both **lower** bounds.
- **Quotient:** the **largest** $\frac{a}{b}$ uses the **largest** a and the **smallest** b .

Answer shapes: **M1** a correct method, **A1** the correct answer.

Method — Upper and lower bounds



Each kind of number sits inside the next

Method — Upper and lower bounds

$-\frac{1}{3}$ included (closed circle) 3 excluded (open circle)



Upper and lower bounds place a value within an interval

Practice 2.1 ■ 1 mark

A length is 24 cm, to the nearest cm. Write down the lower bound.

Solution 2.1

Method: Upper and lower bounds

Worked steps

23.5 cm **B1**.

Practice 2.2 ■ 1 mark

A mass is 3.5 kg, correct to 1 decimal place. Write down the upper bound.

Solution 2.2

Method: Upper and lower bounds

Worked steps

3.55 kg **B1**.

Practice 2.3 ■ 2 marks

A time is 40 s, to the nearest 10 s. Write down the lower and upper bounds.

Solution 2.3

Method: Upper and lower bounds

Worked steps

lower bound 35 s, upper bound 45 s **B1** **B1** +.

Exam-style 3.1 ■ 2 marks

A rectangle measures 12 cm by 7 cm, each side to the nearest cm.

- (a) Calculate the upper bound of the area.
- (b) Calculate the lower bound of the perimeter.

Solution 3.1

Method: Upper and lower bounds

Worked steps

(a) upper bounds 12.5 and 7.5 $\rightarrow$ area = $12.5 \times 7.5 = 93.75 \text{ cm}^2$ **M1** **A1** for 12.5×7.5 ; for 93.75. (b) lower bounds 11.5 and 6.5 $\rightarrow$ perimeter = $2(11.5 + 6.5) = 36 \text{ cm}$ **M1** **A1** for using both lower bounds; for 36.

Exam-style 3.2 ■ 3 marks

A car travels 90 m (to the nearest 10 m) in 8.0 s (to the nearest 0.1 s). Calculate the upper bound of its average speed.

Solution 3.2

Method: Upper and lower bounds

Worked steps

largest speed = largest distance $\div$ smallest time. Distance upper bound = 95 m;
time lower bound = 7.95 s $\rightarrow \frac{95}{7.95} = 11.9$ m/s (to 3 s.f.) **M1** **M1** **A1** for 95 and 7.95; for $\frac{95}{7.95}$; for 11.9.