Your notes

GCSE Maths: revision notes

# Error intervals and bounds

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## Error intervals

- A measurement rounded to a given accuracy could be half a unit above or below the rounded value.
- If x = 7.4 to 1 decimal place, the **error interval** is $7.35 \leq x < 7.45$.
- The **lower bound** (7.35) is included; the **upper bound** (7.45) is not, because 7.45 would round to 7.5.

## Finding bounds

- Halve the unit of rounding, then subtract for the **lower bound** and add for the **upper bound**.
- 50 cm to the nearest 10 cm: bounds 45 cm and 55 cm.
- 70 kg to the nearest 5 kg: bounds 67.5 kg and 72.5 kg.

## Truncation

- Truncating means chopping off digits without rounding. If x = 5.8 truncated to 1 decimal place, then $5.8 \leq x < 5.9$.

## Calculating with bounds (Higher)

- Maximum of a sum: upper + upper. Maximum of a difference: upper – lower.
- Maximum of a product: upper × upper. Maximum of a quotient: upper ÷ lower.
- Minimum of a quotient: lower ÷ upper.
- Give the final answer to a sensible accuracy, where the upper and **lower bounds** agree when rounded.

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## Worked examples

**A length is 12.4 cm, correct to 1 decimal place. Find its lower and upper bounds.**

The measurement is to the nearest 0.1 cm, so it could be up to half of that (0.05) either side. **0.1 ÷ 2 = 0.05**

Lower bound: subtract 0.05. **12.4 − 0.05 = 12.35**

Upper bound: add 0.05. **12.4 + 0.05 = 12.45**

**Answer: 12.35 cm ≤ length < 12.45 cm**

## Key terms

| | |
|---|---|
| **Error interval** | The range of possible values of a rounded number, such as 7.35 ≤ x < 7.45. |
| **Lower bound** | The smallest value that would round to the given value. |
| **Upper bound** | The value above which numbers would round up to the next value; the top of the error interval. |
| **Truncation** | Cutting off digits after a certain point without rounding. |
| **Degree of accuracy** | How precisely a number is given, such as to 1 decimal place. |

## Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. x = 7.4 to 1 decimal place. What is the error interval?
2. A length is 50 cm to the nearest 10 cm. What is its lower bound?
3. A mass is 3.6 kg to 1 decimal place. What is its upper bound?
4. x = 5.8 truncated to 1 decimal place. What is the error interval?
5. 200 is rounded to the nearest 100. What is the lower bound?
6. a = 6 and b = 4, both to the nearest whole number. What is the maximum value of a + b? (Higher)
7. a = 10 and b = 4, both to the nearest whole number. What is the maximum value of a − b? (Higher)
8. a = 20 and b = 5, both to the nearest whole number. Which calculation gives the upper bound of a ÷ b? (Higher)

### Answers

1. 7.35 ≤ x < 7.45
2. 45 cm
3. 3.65 kg
4. 5.8 ≤ x < 5.9
5. 150
6. 11

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7. 7
8. 20.5 ÷ 4.5

## What to do next

**Practise 12 questions on this topic**

**Try 5 exam questions, with mark schemes**

**Read the lesson, one step at a time**

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