# Knowledge Organiser: 7c Accuracy and Bounds

<u>What you need to know</u>: Rounding and Truncation to state error intervals

The upper and lower bound come from the largest and smallest values that would **round** to a particular number.

Take 'half a unit above and half a unit below'. For example rounded to 1 d.p means nearest 0.1, so add 0.05 and subtract 0.05 to get the bounds.

**All error intervals look the same like this:**

$$\leq x <$$

The lowest value a number could have been is the lower bound.
The highest value a number could have been is the upper bound.

E.g. 1 State the upper and lower bound of 360 when it has been **rounded** to 2 significant figures:
2 significant figures is the nearest 10, so 'half this' to get 5, and add on to 360 and take it off 360,

$$355 \leq x < 365$$

**Note:** You should know it could be 364.9999… but we write 365 as the upper bound for ease of calculations.

E.g. 2 **Truncation:** State the error interval of 4.5 when it has been **truncated** to 1decimal place. This means it has been 'chopped off'. The lowest value it could have been is 4.5, thehighest is 4.59999… so in an error interval

$$4.45 \leq x < 4.55$$

## Key Terms:

- Bound
- Upper
- Lower
- Accuracy
- Rounding
- 'to the nearest'
- Truncation
- Suitable degree of accuracy- choose a suitable rounding e.g. 2.d.p as your reason

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**Topic: Bounds 137-139**

**Topic: Error interval 411**

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## Key Facts:

Rounding a number and **truncating** are different things.

Truncation comes from the word *truncare*, meaning "to shorten," and can be traced back to the Latin word for the trunk of a tree, which is *truncus*.

**3.14159265**… can be truncated to 3.1415 (note that if it had been rounded, it would become 3.1416).

A question may ask for the error interval for **rounding** or **truncation** – take care to read the question!

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What you need to know: Using Upper and Lower Bounds in calculations

When completing calculations involving boundaries we are aiming to find the greatest or smallest answer. The table shows how to find these in each operation. If combined, e.g. an add then divide, do each operation separately

| | + | - | × | ÷ |
|---|---|---|---|---|
| **Upper bound answer** | $UB_1 + UB_2$ | $UB_1 - LB_2$ | $UB_1 \times UB_2$ | $UB_1 \div LB_2$ |
| **Lower bound answer** | $LB_1 + LB_2$ | $LB_1 - UB_2$ | $LB_1 \times LB_2$ | $LB_1 \div UB_2$ |

A restaurant provides a cuboid stick of butter to each table. The dimensions are 30mm by 30mm by 80mm, correct to the nearest 5mm. Calculate the upper and lower bounds of the volume of the butter.

$$Volume = l \times w \times h$$

$$Upper\ bound = 32.5 \times 82.5 \times 32.5 = 87140.63mm^3$$

$$Lower\ bound = 27.5 \times 77.5 \times 27.5 = 58609.38mm^3$$

$$D = \frac{x}{y}$$

$x$ = 99.7 correct to 1 decimal place.
$y$ = 67 correct to 2 significant figures.
Give the value of $D$ to a **suitable degree of accuracy.**

**Find the Upper and lower bound first.**

$$Upper\ bound\ D = \frac{99.75}{66.5} = 1.5$$

$$Lower\ bound\ D = \frac{99.65}{67.5} = 1.48$$

**Then decide what the number would round to, to be the same number. To 2 d.p. they would be different. To 1.d.p. they would both be 1.5.**
**The answer is therefore 1.5 correct to 1 decimal place as your answer.**

## Key Terms:

- Bound
- Upper
- Lower
- Accuracy
- Rounding
- Suitable Degree of Accuracy

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**Topic: Error interval 411**

## Key Facts:

The boundaries of a number derive from **rounding**. Do this before completing the calculation (you get marks!)

E.g. State the boundaries of 360 when it has been rounded to 2 significant figures:

$$355 \leq x < 365$$

E.g. State the boundaries of 4.5 when it has been rounded to 2 decimal place:

$$4.45 \leq x < 4.55$$

These boundaries can also be called the **error interval** of a number.