

GCSE – Numeracy and Mathematics

Topic: Upper and lower bounds involving multiplication and division of numbers expressed to a given degree of accuracy

Starter:

1. If 2.5m is correct to 1 decimal place. Find the upper and lower bound of this measurement.
2. If 34500 is correct to 3 significant figures. Find the upper and lower bound.

Skills:

1. The width of a rectangle is 40cm, correct to 2 significant figures. The length is 115cm, correct to 3 significant figures. Calculate the lower bound for the area of the rectangle.
2. Jim ran a distance of 400m in 51.2 seconds. The distance was measured to the nearest 10 metres. The time was correct to the nearest tenth of a second. Work out the upper bound for Jim's average speed in m/s.

Tier: Higher

Grade:

A/A*



Top Tips!

- Whatever the degree of accuracy, halve it. If you add and subtract this value you will find the upper and lower bound.
- When multiplying and dividing it is not a simple case of choosing the largest or smallest values – you must consider the calculation carefully
- **Note – whilst this is accepted as a method for finding the upper bound the actual answer is slightly different**
E.g. If 550m is correct to the nearest 10m, find the upper and lower bound for this measurement.

Degree of accuracy = 10m

Half of degree of accuracy = 5m

Upper bound = $550 + 5 = 555\text{m}$

Lower bound = $550 - 5 = 545\text{m}$

However, the upper bound is technically 554.9m as 555m would round to 560m.

But 555m is accepted in exams.

Examination Question:

2016 Summer Unitised U1 Higher Q 14

Last month, Salim used his car to travel 1000 miles, correct to the nearest 100 miles. He used 26 gallons of petrol, correct to the nearest gallon. Calculate the least and greatest possible values for the number of miles travelled per gallon by this car last month. Give your answers correct to 1 decimal place.[5]

Assessment for Learning

Video / QR code



Starter:

1. If 2.5m is correct to 1 decimal place. Find the upper and lower bound of this measurement.
 Upper bound = 2.55m
 Lower bound = 2.45m
2. If 34500 is correct to 3 significant figures. Find the upper and lower bound.
 UB = 34550, LB = 34450

Skills:

1. The width of a rectangle is 40cm, correct to 2 significant figures. The length is 115cm, correct to 3 significant figures. Calculate the lower bound for the area of the rectangle.
 Width lower bound = 39.5cm
 Length lower bound = 114.5cm
 Area lower bound = $39.5 \times 114.5 = 4522.75\text{cm}^2$
2. Jim ran a distance of 400m in 51.2 seconds. The distance was measured to the nearest 10 metres. The time was correct to the nearest tenth of a second. Work out the upper bound for Jim's average speed in m/s (giving your answer to 1dp).
 Need upper bound of distance and lower bound of time (large \div small = large)
 Distance upper bound = 405m
 Time lower bound = 51.15
 Upper bound for speed = $405 \div 51.15 = 7.9\text{m/s}$

Top Tips!

- Whatever the degree of accuracy, halve it. If you add and subtract this value you will find the upper and lower bound.
- When dividing (or subtracting) it is not a simple case of choosing the largest or smallest values – you must consider the calculation carefully
- **Note – whilst this is accepted as a method for finding the upper bound the actual answer is slightly different**
 E.g. If 550m is correct to the nearest 10m, find the upper and lower bound for this measurement.

Degree of accuracy = 10m
 Half of degree of accuracy = 5m
 Upper bound = $550 + 5 = 555\text{m}$
 Lower bound = $550 - 5 = 545\text{m}$
 However, the upper bound is technically 554.9m as 555m would round to 560m.
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Examination Question:

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Last month, Salim used his car to travel 1000 miles, correct to the nearest 100 miles. He used 26 gallons of petrol, correct to the nearest gallon. Calculate the least and greatest possible values for the number of miles travelled per gallon by this car last month. Give your answers correct to 1 decimal place.[5]

Miles upper bound = 1050 miles
 Miles lower bound = 950 miles
 Gallons upper bound = 26.5 gallons
 Gallons lower bound = 25.5 gallons

 mpg lower bound = $950 \div 26.5 = 35.8\text{mpg}$
 (small \div large)
 mpg upper bound = $1050 \div 25.5 = 41.2\text{mpg}$

