

Upper Lower Bounds Calculations

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

A rectangle measures 8.4 cm by 5.2 cm, each to 1 decimal place. Find the upper bound of its area.

Step 1 · Upper bounds of the sides

8.45 cm and 5.25 cm

Step 2 · Biggest area uses both upper bounds

8.45×5.25

Step 3 · Calculate

44.3625 cm²

Answer: 44.3625 cm²

Check: It is bigger than $8.4 \times 5.2 = 43.68$, upper bound should be ✓

2. Now try one with the steps

Mo runs 120 m (to the nearest 5 m) in 14.2 s (to 1 d.p.). Find the lower bound of his average speed.

Step 1 · Bounds

Step 2 · Slowest speed: smallest distance ÷ LONGEST time

Step 3 · Calculate

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

- 1.** A mass is 46 kg to the nearest kilogram. Write down its upper bound, in kg. [1]

- 2.** A length is 3.7 m to 1 decimal place. Write down its lower bound, in metres. [1]

- 3.** $p = 12$ and $q = 5$, both to the nearest whole number. Find the upper bound of $p + q$. [2]

4. Using $p = 12$ and $q = 5$ (nearest whole number), find the lower bound of $p - q$. [2]

5. Using $p = 12$ and $q = 5$ (nearest whole number), find the upper bound of $p \times q$. [2]

6. Using $p = 12$ and $q = 5$ (nearest whole number), find the lower bound of $p \div q$. Give your answer to 2 decimal places. [2]

7. A square has sides of 6.3 cm to 1 decimal place. Find the lower bound of its perimeter, in cm. [2]

8. A circle has radius 4 cm to the nearest centimetre. Find the upper bound of its area, to 3 significant figures, in cm^2 . [2]

9. A coach travels 250 km (to the nearest 10 km) in 3.5 hours (to the nearest 0.1 hour). Find the upper bound of its average speed in km/h, to 3 significant figures. [3]

10. A stone has mass 640 g (to the nearest 10 g) and volume 80 cm^3 (to the nearest cm^3). Find the lower bound of its density in g/cm^3 , to 3 significant figures. [3]

11. $a = 8.6$ to 1 decimal place and $b = 3.25$ to 2 decimal places. Find the upper bound of $a - b$. [3]

12. A rope is 50 m long to the nearest metre. Jaz cuts pieces that are each 1.2 m to 1 decimal place. [3]
What is the greatest number of whole pieces she could possibly cut?

13. $x = 5.3$ and $y = 0.8$, both to 1 decimal place. Find the upper bound of $x \div y$, to 3 significant figures. [2]

14. $s = \frac{1}{2}gt^2$, where $g = 9.8$ and $t = 2.4$, both to 1 decimal place. Find the lower bound of s , to 3 significant figures. [3]

15. $v = u \div t$, where $u = 48$ to the nearest whole number and $t = 6.1$ to 1 decimal place. Find v to a suitable degree of accuracy, explaining your answer. [4]

4. Before you hand it in

Upper bound of $a - b = \text{upper } a - \text{upper } b$

Subtracting a bigger b makes the answer smaller. For the biggest difference subtract the SMALLEST b : upper $a -$ lower b .

Upper bound of $a \div b = \text{upper } a \div \text{upper } b$

Dividing by a smaller number gives a bigger answer. Upper $a \div$ LOWER b .

Writing the upper bound of 8 (nearest whole) as 8.49 or 8.4999

By convention the upper bound is 8.5. The error interval $7.5 \leq x < 8.5$ shows it cannot actually equal 8.5.

Giving a 'suitable degree of accuracy' answer as 3.09 or to the same accuracy data

Round both bounds to the same accuracy and keep the most accurate version on which they AGREE, then state it, e.g. 'both round to 3 (1 s.f.)'.