



eClassroom

GCSE Mathematics

Error Intervals & Bounds

Questions

Pearson Edexcel GCSE & iGCSE Mathematics



Section A — Foundation

Worked Examples

[Fluency]

A length x is measured as 13 cm, rounded to the nearest centimetre. Write down the error interval for x .

Half the rounding unit = 0.5 cm

Lower bound: $13 - 0.5 = 12.5$ Upper bound: $13 + 0.5 = 13.5$

$$12.5 \leq x < 13.5$$

[Reasoning]

$p = 7.4$ and $q = 2.1$, both rounded to 1 decimal place. Write the error interval for $p + q$.

p : [7.35, 7.45) q : [2.05, 2.15)

Lower bound of $p + q$: $7.35 + 2.05 = 9.40$

Upper bound of $p + q$: $7.45 + 2.15 = 9.60$

$$9.40 \leq p + q < 9.60$$

[Problem Solving]

A rectangle has length 8.6 cm and width 4.2 cm, both measured to 1 decimal place. Find the upper bound of the area.

Upper bound of length = 8.65 cm Upper bound of width = 4.25 cm

Upper bound of area = $8.65 \times 4.25 = 36.7625 \text{ cm}^2$

[Fluency]

1. A number x is rounded to the nearest whole number and gives 47.

Write down the error interval for x .

(2 marks)

[Fluency]

2. A length is measured as 8.3 cm, rounded to 1 decimal place.

Write down the error interval for the length.

(2 marks)

[Fluency]

3. A crowd size is given as 150, rounded to the nearest 10.

Write down the error interval for the crowd size.

(2 marks)

**[Fluency]**

4. A mass m is recorded as 6.0 kg, rounded to 1 decimal place.

Write down the error interval for m .

(2 marks)

[Fluency]

5. A distance d is given as 3400 m, rounded to the nearest 100 m.

Write down the error interval for d .

(2 marks)

[Reasoning]

6. $p = 8.4$ and $q = 3.2$, both rounded to 1 decimal place.

Find the upper and lower bounds of $p + q$.

Write your answer as an error interval.

(3 marks)

[Reasoning]

7. $a = 12$ and $b = 5$, both rounded to the nearest integer.

(a) Write down the upper bound of $a - b$. (b) Write down the lower bound of $a - b$.

(3 marks)

[Reasoning]

8. A rectangle has length 6.4 cm and width 3.1 cm. Both measurements are given to 1 decimal place.

(a) Find the upper bound of the area of the rectangle. (2)

(b) Find the lower bound of the area of the rectangle. (2)

(4 marks)

[Problem Solving]

9. A box of chocolates has a mass of 240 g, measured to the nearest 10 g.

12 identical boxes are packed into a crate.

Find the upper and lower bounds for the total mass of the 12 boxes.

(3 marks)

[Problem Solving]

10. A metal cylinder has a density of 8.9 g/cm^3 and a volume of 15 cm^3 .

The density is given to 1 decimal place and the volume is given to the nearest integer.

Mass = Density \times Volume

(a) Find the upper bound for the mass of the cylinder. (2)

(b) Find the lower bound for the mass of the cylinder. (2)

(4 marks)



Section B — Higher

Worked Examples

[Fluency]

A number n is truncated to 2 significant figures to give 3.8. Write the error interval for n .

Truncation to 2 s.f.: the number is cut, not rounded.

The lower bound is 3.8 exactly. The upper bound is 3.9 (not included).

$$3.8 \leq n < 3.9$$

[Reasoning]

$t = 4.6$ seconds, rounded to 1 decimal place. Find the upper and lower bounds of t^2 .

$$t \in [4.55, 4.65)$$

$$\text{Lower bound of } t^2 = 4.55^2 = 20.7025$$

$$\text{Upper bound of } t^2 = 4.65^2 = 21.6225$$

$$20.7025 \leq t^2 < 21.6225$$

[Problem Solving]

A car travels a distance of 95 miles, rounded to the nearest 5 miles, at a speed of 40 mph, rounded to the nearest 10 mph. Find the upper bound of the time taken.

Upper bound of time = maximum distance \div minimum speed

$$\text{Max distance} = 97.5 \text{ miles} \quad \text{Min speed} = 35 \text{ mph}$$

$$\text{Upper bound of time} = \frac{97.5}{35} \approx 2.786 \text{ hours}$$

[Fluency]

1. A number x is truncated to 2 significant figures to give 0.057.

Write the error interval for x .

(2 marks)

[Fluency]

2. A number is rounded to 2 significant figures and gives 4700.

Write the error interval for the number.

(2 marks)

**[Fluency]**

3. $t = 2.8$ seconds, rounded to 1 decimal place.
- (a) Write down the upper and lower bounds of t . (1)
- (b) Find the upper and lower bounds of t^2 . (2)

(3 marks)

[Reasoning]

4. $x = 3.4$ cm and $y = 1.8$ cm, both rounded to 1 decimal place.
- (a) Find the upper bound of $x \div y$. (2)
- (b) Find the lower bound of $x \div y$. (2)

(4 marks)

[Reasoning]

5. A car travels a distance of 45 miles, rounded to the nearest 5 miles, at a speed of 60 mph, rounded to the nearest 10 mph.

Time = Distance \div Speed

- (a) Find the upper bound of the time taken. Give your answer in minutes. (3)
- (b) Find the lower bound of the time taken. Give your answer in minutes. (2)

(5 marks)

[Reasoning]

6. $p = 2.8$ and $q = 1.4$, both rounded to 1 decimal place.

Show that the upper bound of $p \div q$ is $\frac{19}{9}$.

(3 marks)

[Problem Solving]

7. Three resistors are connected in series. Their resistances are measured as $R_1 = 4.7\Omega$, $R_2 = 8.3\Omega$ and $R_3 = 2.1\Omega$, all rounded to 1 decimal place.

Total resistance $R = R_1 + R_2 + R_3$

- (a) Find the upper bound of R . (2)
- (b) Find the lower bound of R . (2)

(4 marks)

**[Problem Solving]**

8. The area of a circle is measured as 154 cm^2 , rounded to the nearest cm^2 .

$$\text{Area} = \pi r^2$$

(a) Find the upper bound of the radius. Give your answer correct to 4 decimal places. (3)

(b) Find the lower bound of the radius. Give your answer correct to 4 decimal places. (2)

(5 marks)

[Problem Solving]

9. A particle moves using the equation $s = ut + \frac{1}{2}at^2$, where:

$u = 12 \text{ m s}^{-1}$ (rounded to the nearest integer)

$t = 3.0 \text{ s}$ (rounded to 2 significant figures)

$a = 2 \text{ m s}^{-2}$ (rounded to 1 significant figure)

(a) Find the upper bound of s . (3)

(b) Find the lower bound of s . (3)

(6 marks)

[Problem Solving]

10. A value is recorded as 5.7.

(a) Write the error interval if 5.7 was obtained by **rounding** to 1 decimal place. (1)

(b) Write the error interval if 5.7 was obtained by **truncating** to 1 decimal place. (1)

(c) Explain the key difference between rounding and truncating, and state which produces a smaller maximum error. (2)

(4 marks)