



Upper and lower bounds

Year 8 About 70 minutes Calculator allowed 50 marks

Date _____

A Do Now

Quick questions to start.

- A1** Needed today [1 mark] Round 2650 to the nearest hundred.
- A2** Last lesson [1 mark] Work out $(8 \times 10^6) \div (2 \times 10^{-3})$. Give your answer in standard form.

Answer

Answer

- A3** From chapter 8 [1 mark] Factorise $x^2 + 7x + 12$.
- A4** Year 7 [1 mark] Round 0.0538 to 1 significant figure.

Answer

Answer

B Example, then your turn

Year 8

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

Write down the lower bound and the upper bound of each measurement.

- (a) 70 cm, to the nearest 10 cm
- (b) 3.6 kg, to 1 decimal place

Hint Go half a unit each way. Half of 10 cm is 5 cm; half of 0.1 kg is 0.05 kg.

- B1** Write down the lower bound and the upper bound of each measurement. [2 marks]

- (a) 400 m, to the nearest 100 m
- (b) 12.8 seconds, to 1 decimal place

Answer (a) (b)

EXAMPLE 2

Write the error interval for each length L .

- (a) $L = 6000$ m, to 1 significant figure
- (b) $L = 0.47$ m, to 2 significant figures

Hint The last significant figure tells you the unit: 6000 to 1 s.f. is to the nearest 1000. Use $\leq$ at the bottom and $<$ at the top.

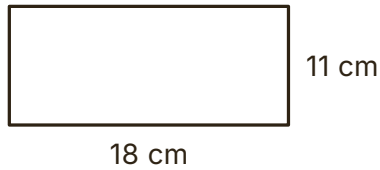
- B2** Write the error interval for each mass m . [2 marks]

- (a) $m = 900$ g, to 1 significant figure
- (b) $m = 0.082$ kg, to 2 significant figures

Answer (a) (b)

EXAMPLE 3

Each length of this rectangle is given to the nearest centimetre. Work out the least and the greatest possible perimeter.

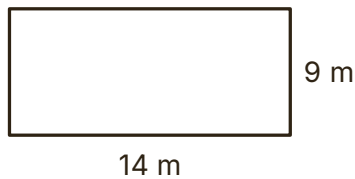


Not drawn accurately

Hint Use the lower bounds for the least perimeter and the upper bounds for the greatest.

EXAMPLE 4

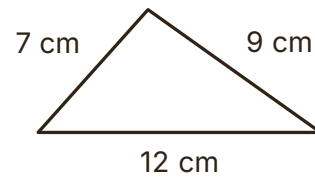
Each length of this rectangle is given to the nearest metre. Work out the least and the greatest possible area.



Not drawn accurately

Hint Multiply the two lower bounds, then the two upper bounds.

B3 Each side of this triangle is given to the nearest centimetre. Work out the least and the greatest possible perimeter. [3 marks]



Not drawn accurately

Answer least greatest

B4 This square has sides of 6.4 cm, to 1 decimal place. Work out the least and the greatest possible area. [3 marks]



Not drawn accurately

Answer least greatest

EXAMPLE 5

Ella runs 100 m, to the nearest metre, in 12 seconds, to the nearest second. Work out her greatest and least possible average speed. Give your answers to 3 significant figures.

Hint Speed = distance $\div$ time. A big answer needs a big distance and a small time.

B5 Kai cycles 36 km, to the nearest km, in 1.5 hours, to the nearest 0.1 hour. Work out his greatest and least possible average speed. Give your answers to 1 decimal place. [4 marks]

Answer greatest least

c Practice

Year 8

C1 The number of people at a concert is 2700, to the nearest 100. Write down the least and the greatest possible number of people. [2 marks]

Answer least greatest

C3 $x = 7.2$ and $y = 3.5$, both correct to 1 decimal place. Work out the least possible value of $x \times y$. [2 marks]

Answer

C2 Two pieces of wood are 15 cm and 8 cm long, each to the nearest centimetre. Work out the greatest possible difference between their lengths. [2 marks]

Answer

C4 A shelf is 80 cm long, to the nearest cm. Twenty books are each 4.0 cm thick, to the nearest mm. Can you be sure that all 20 books will fit on the shelf? Give a reason. [2 marks]

D1 Answer each part.

- (a) A length is 540 mm, to the nearest 10 mm. Write down its lower bound. [1 mark]

Answer

- (b) A mass is 8.7 kg, to 1 decimal place. Write down its upper bound. [1 mark]

Answer

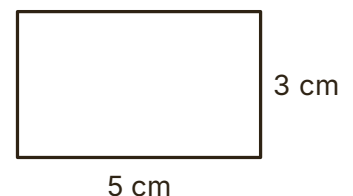
- (c) A time is $t = 30$ seconds, to the nearest 5 seconds. Write down the error interval for t . [2 marks]

Answer

Total for D1: 4 marks

- D2** A rectangle is 5 cm long and 3 cm wide, both to the nearest centimetre. Sam says, "The greatest possible area is $6 \times 4 = 24 \text{ cm}^2$." [3 marks]

Explain what Sam has done wrong. Work out the greatest possible area of the rectangle.



Not drawn accurately

- D3** Ben lays 30 tiles in a row along a wall. Each tile is 20 cm long, to the nearest centimetre. The wall is 6 m long, to the nearest 10 cm. Can Ben be sure that the row of tiles covers the whole length of the wall? You must show your working. [4 marks]

- D4** A bag holds 25 kg of sand, to the nearest kg. Some of the sand is used. The bag now holds 21.6 kg of sand, to 1 decimal place.

- (a) Write down the upper bound of 25 kg. [1 mark]

Answer

(b) Write down the lower bound of 21.6 kg.

[1 mark]

Answer

(c) Work out the greatest possible mass of sand that was used.

[2 marks]

Answer

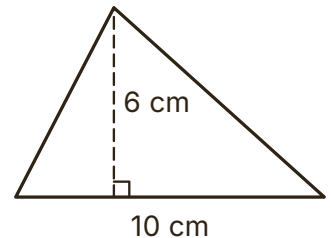
(d) Work out the least possible mass of sand that was used.

[1 mark]

Answer

Total for D4: 5 marks

D5 The base and the height of this triangle are each given to the nearest centimetre. [4 marks]
Work out the least and the greatest possible area of the triangle.



Answer least greatest

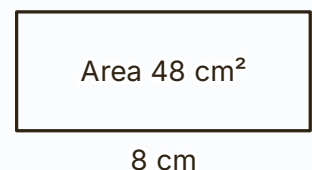
Not drawn accurately

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 This rectangle has an area of 48 cm^2 , to the nearest cm^2 . Its length is 8 cm, to the nearest cm. Work out the greatest and the least possible width. Give your answers to 3 significant figures. [4 marks]



Answer greatest least

Not drawn accurately

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Width = area $\div$ length. Write down the bounds of the area and of the length.
- Hint 2** The area is between 47.5 and 48.5; the length is between 7.5 and 8.5.
- Hint 3** Greatest width = $48.5 \div 7.5$. Least width = $47.5 \div 8.5$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can write down the upper and lower bounds of a rounded measurement.



I can write an error interval such as $5500 \leq L < 6500$.



I can choose which bounds give the least and greatest perimeter, area, speed or difference.

