



3.3H Estimating: Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 75 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Round each number to 1 significant figure then work out the sum.

$$7.8 + 0.64 + 12.3$$

(Total for Question 1 is 2 marks)

- 2** Give an estimate for 47×0.98 by rounding one or both numbers and show your working.

(Total for Question 2 is 2 marks)

- 3** Estimate the value of $\sqrt{198}$ to the nearest whole number. Show your method.

(Total for Question 3 is 2 marks)

- 4** A recipe needs 0.375 kg of flour per batch. A chef will make 28 batches. Use an appropriate rounding to estimate the total mass of flour needed in kg and state why your rounding is suitable.

(Total for Question 4 is 3 marks)

- 5 Show that 6.02×10^4 is approximately equal to 6.0×10^4 to 2 significant figures. Explain whether it is acceptable to use 6.0×10^4 as an estimate when calculating a value to 2 significant figures.

(Total for Question 5 is 3 marks)

- 6 A student measures the length of a metal rod as 124.3 mm with a ruler marked to the nearest 0.5 mm. Give the upper and lower bounds for the measurement and hence estimate the maximum possible percentage error in the measurement (give your answer to 2 significant figures).

(Total for Question 6 is 4 marks)

- 7 A car journey of 315 km takes 3 hours 12 minutes. The driver records the journey time with a stopwatch to the nearest minute. Estimate the average speed in km/h and give an upper and lower estimate for the speed using bounds from the timing measurement. Give answers to 3 significant figures.

(Total for Question 7 is 5 marks)

Mark scheme · 3.3H Estimating: Higher Tier Practice

Question 1

- **M1** round each number to 1 sf: 7.8 → 8, 0.64 → 0.6, 12.3 → 10
- **A1** sum = 18.6 cao
- **Answer: 18.6**
(8 + 0.6 + 10 = 18.6)

Question 2

- **M1** use a sensible rounding method, e.g. 47 ~ 50 or 0.98 ~ 1 or both
- **A1** give an estimated product with working, e.g. 50 x 1 = 50 or 47 x 1 = 47 (accept 49 from 50 x 0.98) cao
- **Answer: 50**
(example: 47 ~ 50 and 0.98 ~ 1, 50 x 1 = 50)

Question 3

- **M1** identify nearest square or use rounding: note $\sqrt{196} = 14$ or 198 ~ 200
- **A1** estimate 14 to the nearest whole number cao
- **Answer: 14**
(using $\sqrt{196} = 14$ or 198 ~ 200 so sqrt ~ $\sqrt{200} \sim 14$ to the nearest whole number)

Question 4

- **M1** choose a sensible rounding, e.g. 0.375 ~ 0.38 or 0.375 ~ 0.4 and state reason
- **M1** multiply rounded value by 28 (method shown)
- **A1** final estimate with reason, e.g. 0.4 x 28 = 11.2 kg with explanation that rounding up ensures enough flour cao
- **Answer: 11.2 kg**
(using 0.375 ~ 0.4; 0.4 x 28 = 11.2 kg. Rounding up ensures the chef has enough flour.)

Question 5

- **M1** round 6.02 to 2 sf giving 6.0
- **A1** state $6.02 \times 10^4 \sim 6.0 \times 10^4$ cao
- **B1** give an explanation about acceptability: yes because rounding to 2 sf preserves required precision or note relative error is small oe
- **Answer: 6.0×10^4**
(6.02 rounded to 2 sf is 6.0, so $6.02 \times 10^4 \sim 6.0 \times 10^4$. It is acceptable to use 6.0×10^4 for estimates to 2 sf since the value is within the rounding error.)

Question 6

- **M1** give lower and upper bounds: 124.05 mm and 124.55 mm (or state $124.05 \leq L < 124.55$)
- **M1** state the absolute max error is 0.25 mm
- **M1** calculate percentage error = $(0.25 / 124.3) \times 100$
- **A1** final percentage error 0.20% awrt to 2 sf cao
- **Answer: Lower bound 124.05 mm, upper bound 124.55 mm. Maximum percentage error = 0.20% ($0.25/124.3 \times 100 = 0.201\% \rightarrow 0.20\%$ to 2 sf).**

Question 7

- **M1** convert recorded time 3 h 12 min = 192 min and use nearest-minute bounds: 191.5 min to 192.5 min (convert to hours)
- **M1** compute central estimate speed = $315 / 3.2 = 98.4375$ km/h
- **M1** use bounds to find lower and upper speeds: speed_lower = $315 / (192.5/60)$, speed_upper = $315 / (191.5/60)$
- **M1** compute numerical lower and upper speeds (method shown)
- **A1** final answers to 3 sf: estimate 98.4 km/h, lower 98.2 km/h, upper 98.7 km/h cao
- **Answer: Central estimate 98.4 km/h, lower estimate 98.2 km/h, upper estimate 98.7 km/h.**
Working: 3 h 12 min = 192 min = 3.2 h so central = $315/3.2 = 98.4375 \rightarrow 98.4$ (3 sf). Time bounds: 191.5 min (3.1916667 h) gives speed = $315/3.1916667 = 98.6945 \rightarrow 98.7$ (3 sf). 192.5 min (3.2083333 h) gives speed = $315/3.2083333 = 98.1818 \rightarrow 98.2$ (3 sf).