Higher Check In - 4.01 Approximation and estimation

1. Truncate $9.87635\,\text{m/s}^2$ to 2 decimal places and state the error interval.

2. A calculator displays the answer 10.61428042 to the calculation $\dfrac{21^2}{0.826 \times 50.3}$.

   Round the answer to an appropriate degree of accuracy.

3. If $x = 4.7$ and $y = 10.9$ correct to 1 decimal place, calculate the maximum value of $\dfrac{x}{y}$.

4. Find the range of possible values for a length of cable measuring 24.3 m to the nearest 10 cm. Give the answer as an inequality.

5. A rectangular garden measures 11.5 m by 14.8 m to 3 significant figures. What is the lower bound of the length of the diagonal?

6. Write an appropriate estimate to show that $\dfrac{\sqrt[3]{985.2}}{(4.15 + 0.7)^2} \approx 0.4$.

7. Explain why the error interval of 400 cars to the nearest 50 cars could be written as $375 \leq c \leq 424$ or $375 \leq c < 425$.

8. Tom bought one tonne of sugar, correct to the nearest kilogram for £2200.
   He repackages the sugar to sell at £1.10 per 500 grams.
   Explain why he may make a loss if his scales are only correct to the nearest 10 grams.

9. Calculate the maximum area of a circle enclosed by a rope of 18.5 m, measured to 3 significant figures.

10. The table below gives the personal best times for a 4×400 m relay team.

Team Member	Terry	Marvin	Kazim	Han
Personal Best	48 seconds	56 seconds	51 seconds	54 seconds

    All measurements are given to 2 significant figures. Find the maximum and minimum average speed for the team.

Extension (Do not use a calculator)

A West End theatre group are performing a show twice a day, every day for the month of July at a local theatre.

The theatre has the following range of seating price options:

	Stalls	Dress Circle	Upper Circle
Afternoon show price	£37.50	£28.50	£19.50
Evening show price	£51.50	£37.50	£22.50

There are 27 rows of 32 seats in the dress circle. The dress circle has half the number of seats as the stalls and the upper circle has a third of the number of seats as the dress circle.

A journalist from the local news interviewed the manager of the theatre. The manager was reported to say that the show had sold out in July and broken their £10 million box office record.

Show your working to explain whether you agree or disagree with the manager.

Answers

1. $9.87\,\text{m/s}^2,\ 9.87 \le x < 9.88$

2. 10.614 (3 dp) (Answer need be no more accurate than the original values in the calculation)

3. 0.438 (3 sf)

4. $24.25 \le x < 24.35$

5. 18.7 m

6. $\dfrac{\sqrt[3]{1000}}{(4+1)^2} \approx \dfrac{10}{25} \approx \dfrac{2}{5} \approx 0.4$

7. Cars are discrete data so 424 is the maximum number of cars. However, there is no possible number the value can take between 424 and 425, so < 425 is also appropriate.

8. $\dfrac{999500}{505} \times 1.1 = £2177.13$ which is less than £2200.

9. $27.4\,\text{m}^2$

10. Maximum $= 7.83$ m/s, minimum $= 7.49$ m/s

Extension

No, I don't agree with the manager as approximately £9 million of sales income would be generated.

	Number of Seats	Tickets Sold Per Day	Tickets Sold in July
Dress Circle	30 × 30 = 900	900 × 70 = £63 000	
Stalls	900 × 2 = 1800	2000 × 90 = £180 000	
Upper Circle	900 ÷ 3 = 300	300 × 40 = £12 000	
Total		£255 000 or £270 000	£300 000 × 30 = £9 000 000

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Use inequality notation to write the error interval of a truncated value			
AO1	2	Round to an appropriate degree of accuracy			
AO1	3	Calculate upper bound of a calculation using measurements rounded to a known degree of accuracy			
AO1	4	Use inequality notation to write the error interval of a rounded value			
AO1	5	Calculate lower bound of a calculation using measurements rounded to a known degree of accuracy			
AO2	6	Use appropriate approximations to make an estimation of a complex calculation			
AO2	7	Understand the difference between error bounds for discrete and continuous quantities			
AO2	8	Use appropriate upper and lower bound values in a calculation set in a context			
AO3	9	Use appropriate upper bound values in calculations using geometric formulae			
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