

- 13 In a physics experiment a trolley is timed as it runs down a ramp 1.000 m long (to the nearest millimetre) to find its estimated speed. The speed in metres per second is calculated using  $v = \frac{d}{t_1 - t_2}$ . At the start of the experiment ( $t_1$ ), the stopwatch shows 0.2 s and at the end ( $t_2$ ) it shows 1.4 seconds (both correct to the nearest 0.1 second). Find the upper and lower bounds for  $v$ , giving your answer correct to 3 significant figures.

CAMBRIDGE IGCSE Mathematics - Standard 10<sup>th</sup>  
Exercise 13.5 - Page 417 - Year 2024

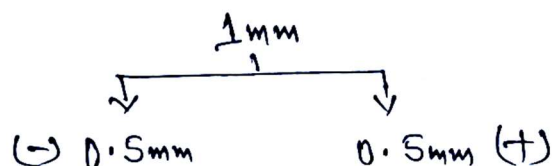
Q13/. Given: ramp 1.000 m long  
 and solution (to the nearest millimetre)  
 (mm)

1m = 100 cm
1cm = 10mm

SO, 1m = 100 × 10 mm  
1m = 1000 mm

• Ramp -

Now, to the nearest mm, means



so,

$$\underset{\text{lower}}{999.5} \leq 1000\text{mm} < 1000.5\text{mm} \quad \text{upper}$$

• Time -

$$\left. \begin{array}{l} t_1 - 0.2\text{s} \\ t_2 - 1.4\text{s} \end{array} \right\} \text{(corrected to the nearest } \underline{0.1\text{ sec.}})$$

so,

$$0.15\text{s} \leq t_1 < 0.25\text{s} \quad (0.2\text{s})$$

$$1.35\text{s} \leq t_2 < 1.45\text{s} \quad (1.4\text{s})$$

$$v \text{ (speed)} = \frac{d}{t_2 - t_1} \quad (\text{given})$$

\* it should be  $t_2 - t_1$  and not  $t_1 - t_2$

$$v_{\text{lower}} = \frac{999.5}{1000 \times (1.45 - 0.15)} \leq v_{\text{speed}} < v_{\text{upper}} = \frac{1000.5}{1000 \times (1.35 - 0.25)}$$

$$= 0.76884$$

$$= 0.769 \quad (\text{3 s.f.}) \quad \text{m/s}$$

$$= 0.9095454$$

Answer = 0.910 m/s (3 s.f.)