Walking Talking - Bounds and Estimation

1.

Calculate $\sqrt{(24{\cdot}6 - 13{\cdot}8)^3}$, correct to 3 significant figures. [2]

$\sqrt{10{\cdot}8^3} = \sqrt{1259{\cdot}712} = 35{\cdot}492421 73$

$= 35{\cdot}5$ (3sf)

2.

You will be assessed on the quality of your written communication in this question.

A handrail alongside a straight path is 60 metres long, measured correct to the nearest 10 cm.

Thin strips of metal of length 40 cm, measured correct to the nearest centimetre, are attached, end to end, along the top of the handrail.
These metal strips must cover the whole length of the handrail.

What is the minimum number of metal strips required to guarantee that the whole length of the handrail is covered?

minimum number → strips need to be as long as possible AND handrail as small as possible

60m = 6000cm

handrail 5990 6000 6010

LB 5995 UB 6005

OR half of 10 is 5

LB = 6000 − 5 = 5995

strips 39 40 41

LB 39.5 UB 40.5

OR half of 1 is 0.5

UB = 40 + 0.5 = 40.5

number of strips needed = $\frac{5995}{40.5} = 148{\cdot}02469\ldots$

[7]

↳ so 149 strips needed to cover the rail

3.

Lois ran 7 km in 25 minutes and 23 seconds.

The distance was measured correct to the nearest 10 metres.
The time was measured correct to the nearest second.

Calculate her greatest possible average speed.
Give your answer in metres per second.
You **must** show how you arrived at your answer. [6]

Speed = $\frac{\text{distance}}{\text{time}}$

greatest possible speed → $\frac{\text{greatest distance (UB)}}{\text{shortest time (LB)}}$

D: 7 km = 7000 m

6990 7000 7010
UB
7005

OR half of 10 is 5
7000 + 5 = 7005

T: 25 mins 23 secs = 1500 + 23 = 1523 seconds

25 mins × 60 = 1500 secs

1522 1523 1524
LB
1522.5

OR half of 1 is 0.5
1523 − 0.5 = 1522.5

Speed = $\frac{\text{distance}}{\text{time}} = \frac{7005\text{m}}{1522.5\text{sec}} = 4.60098\ldots$

= 4.6 m/s (1 dp)

4.

The length of a corridor wall is 68 metres, correct to the nearest metre.

Decorative wall tiles each have a length of 36 cm, correct to the nearest cm.

A decorator is given the job of fitting one single row of these tiles, lengthwise, side by side, along the top of one wall of the whole corridor.

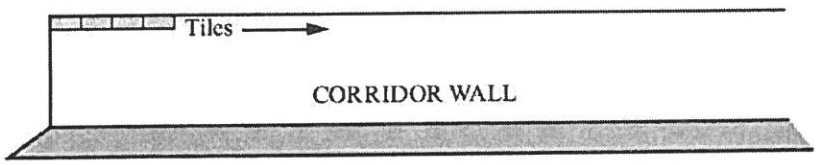


Diagram not drawn to scale

Showing all your calculations, find the least possible number of tiles and the greatest possible number of tiles required.

least tiles → shortest corridor (LB)

longest tiles (UB)

corridor: 67 68 69

LB UB

67.5 67.5m = 6750cm

tiles 35 36 37

UB

36.5

tiles = $\frac{6750}{36.5}$ = 184.9315...

↳ 185 tiles needed to cover

[6]

5.

A water company engineer is investigating a leaking pipe.
He finds that, between 2:00 p.m. and 7:00 p.m., the volume of water that has leaked from the pipe was 8 litres, **measured correct to the nearest litre**.

Calculate the greatest possible volume of water that would be lost in 7 days at this rate. [4]

2.00pm → 7.00pm = 5 hours

8 litres to nearest litre 7.5 8 9

8.5

8.5 litres / 5 hours = 1.7 litres per hour

24 hours (1 day) × 7 = 168 hours

1.7 × 168 = 285.6 litres

6.

Heather wants to attach tape around the rim of the bases of two decorative displays.
In each case the tape attached does not overlap itself.

One of the bases is circular with a diameter of 50 cm.
The other base is a rectangle 45 cm long and 32 cm wide.
All the above measurements are correct to the nearest centimetre.

Show that it is not certain that the length of tape around the circular base will be longer than the length of tape around the rectangular base.

we want to show circular base (LB) < rectangular base (UB)

circular base = π x diameter

= $\pi \times 49.5 = 155.508\ldots$

49 50 51

LB

49.5

rectangular = UB long + UB wide + UB long + UB wide

45.5 + 32.5 + 45.5 + 32.5 = 156cm

44 45 46 31 32 33

UB UB

45.5 32.5

155.508... < 156 so not certain

[5]

7.

(a) Two boxes are stacked on top of each other.
The height of each box is 6 cm, measured to the nearest centimetre.

Explain why these two boxes may not fit in a space that is 12 cm high.

we want to show more than 12 cm ∴ UB needed

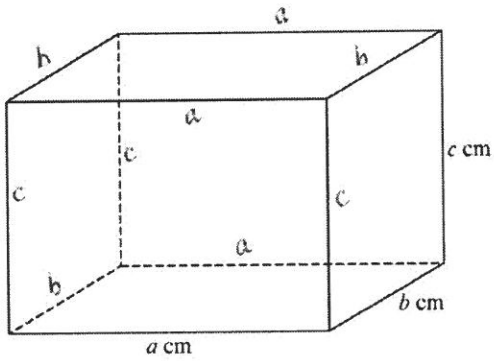
5 **6** 7 2 boxes so 6.5 × 2 = 13

UB

6.5 13 > 12 so may not fit in 12cm space

[2]

(b) Joseph works in a factory that makes boxes.
The boxes are all cuboids.
Each cuboid has dimensions a cm, b cm and c cm.



Joseph has been asked to write a simplified expression for the total length of all the edges of the cuboid.
Joseph writes down the expression $2a + 3b + 4c$.
Joseph's expression is incorrect.

What should the correct simplified expression be for the total length of all the edges?

a + a + a + a + b + b + b + b + c + c + c + c

4a + 4b + 4c

[2]