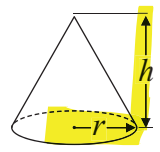


1. A cone has a volume of 98 cm^3 .

The radius of the cone is 5.13 cm .

- (a) Work out an estimate for the height of the cone.

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



$$V = \frac{1}{3} \pi r^2 h. \quad 98 = \frac{1}{3} \pi (5.13)^2 \times h$$

$$98 = \left(\frac{\pi (5.13)^2}{3} \right) h. \quad 98 \div \left(\frac{\pi (5.13)^2}{3} \right) = h. \quad h = \frac{300}{25\pi} \approx \frac{12}{3.14} \approx \frac{12}{3}$$

$$\left(98 \times \frac{3}{\pi (5.13)^2} \right) = h. \quad \frac{98 \times 3}{\pi (5.13)^2} = h. \quad \frac{100 \times 3}{\pi (5)^2} = h. \quad 4 \text{ cm}$$

John uses a calculator to work out the height of the cone to 2 decimal places.

- (b) Will your estimate be more than John's answer or less than John's answer?

Give reasons for your answer.

more because the number in the numerator rounds up and the numbers in the denominator round down.

(1)

(Total for Question is 4 marks)

2. A train travelled along a track in 110 minutes, correct to the nearest 5 minutes.

Jake finds out that the track is 270 km long.

He assumes that the track has been measured correct to the nearest 10 km.

- (a) Could the average speed of the train have been greater than 160 km/h?

You must show how you get your answer.

→ upper bound.

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

$$\text{U.B. for division} = \frac{\text{upper bound}}{\text{lower bound}}$$

$$\text{Distance: } 265 \leftarrow 270 \text{ km} \rightarrow 275 \quad (1)$$

$$\text{Time: } 107.5 \leftarrow 110 \text{ mins} \rightarrow 112.5$$

$$\text{max. speed} = \frac{275}{(107.5 \div 60)} = 153.4883721 \quad (1)$$

NO, because the max. speed is 153.488 km/h, and this is less than 160 km/h. (1)

(4)

Jake's assumption was wrong.

The track was measured correct to the nearest 5 km.

- (b) Explain how this could affect your decision in part (a).

Less distance is covered in the same amount of time, and so the max. speed will decrease.

(1)

(1)

(Total for Question is 5 marks)

3. A cycle race across America is 3069.25 miles in length.

Juan knows his average speed for his previous races is 15.12 miles per hour.
For the next race across America he will cycle for 8 hours per day.

(a) Estimate how many days Juan will take to complete the race.

↳ = must use rounded values to obtain marks - do not use the values in the question

3069.25 miles \rightarrow 3000 miles

15.12 mph \rightarrow 15 mph



$$\text{time} = \frac{\text{distance}}{\text{Speed}} = \frac{3000 \text{ miles}}{15 \text{ mph}} \quad (1)$$

$$= 200 \text{ hours}$$

$$\frac{200}{8} = 25 \text{ days} \quad (1)$$

8 hours per day

$$\underline{25} \quad (1)$$

(3)

Juan trains for the race.

The average speed he can cycle at increases.
It is now 16.27 miles per hour.

$$t = \frac{d}{s} \quad \uparrow s = \downarrow t$$

(b) How does this affect your answer to part (a)?

less days required

or the answer is not affected (16.27 can be rounded down to 15 still)

time and speed are inversely proportional, so an increase in average speed results in the time taken decreasing.
So less time is required to complete the race.

(1)

(Total for Question is 4 marks)

$$120 \times 5 = 600 \text{ minutes}$$

1 tap takes 600 minutes

$$600 \div 3 = 200 \text{ minutes}$$

200

Each tap fills up pool at the same rate

4. A plane travels at a speed of 213 miles per hour.

- (a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

$$213 \rightarrow 200$$

200 miles per 1 hour

200 miles per 60 minutes

200 miles per 3600 seconds

$$\downarrow \div 200$$

$$\downarrow \div 200$$

1 mile per 18 seconds

18

seconds

(3)

- (b) Is your answer to part (a) an underestimate or an overestimate?
Give a reason for your answer.

Overestimate, because we rounded the speed down

(1)

(Total for Question is 4 marks)

5. (a) Work out an estimate for the value of $\sqrt{63.5 \times 101.7}$

$$\approx \sqrt{64 \times 100} \quad (1)$$

$$\approx \sqrt{64} \times \sqrt{100}$$

$$\approx 8 \times 10$$

$$\approx 80.$$

(1)

80

(2)

$(2.3)^6 = 148$ correct to 3 significant figures.

- (b) Find the value of $(0.23)^6$ correct to 3 significant figures.

$$0.23 = \frac{2.3}{10}$$

$$\therefore (0.23)^6 = \left(\frac{2.3}{10}\right)^6 = \frac{(2.3)^6}{10^6} = \frac{148}{10^6}$$

$$= 0.000148.$$

(1)

0.000148

(1)

- (c) Find the value of 5^{-2}

$$5^{-2} = \frac{1}{5^2} = \frac{1}{25}.$$

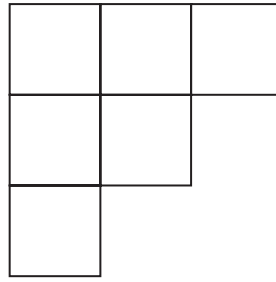
(1)

 $\frac{1}{25}.$

(1)

(Total for Question is 4 marks)

6. The diagram shows a shape made from 6 identical squares.



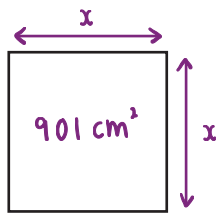
The total area of the shape is 5406 cm^2

- (a) Find an estimate for the length of one side of each square.
Give your answer correct to the nearest whole number.

Area of one square :

$$5406 \div 6 = 901 \text{ cm}^2 \quad (1)$$

Find length of one side :



$$(x)(x) = 901$$

$$x^2 = 901$$

$$x = \sqrt{901}$$

$$x \approx \sqrt{900} \quad (1)$$

$$\approx 30 \text{ cm (to the nearest whole)}$$

(1)

30 cm
(3)

- (b) Is your answer to part (a) an underestimate or an overestimate?
You must give a reason for your answer.

underestimate because the length was rounded down. (1)

(1)

(Total for Question is 4 marks)