

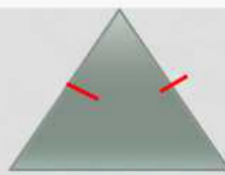
ESTIMATION & PERCENTAGE ERROR

HOMework:
PAGE 19-20-1K: ALL
PAGE 21-1L: ALL

ASSUMED KNOWLEDGE

NOTE: IN YOUR FORMULAE BOOKLET THIS IS CALLED "PRIOR LEARNING"


- Congruent Symbols



- Perimeter/Area of basic shapes: squares, rectangles...

$$A = l \times w$$
$$P = 2l + 2w$$

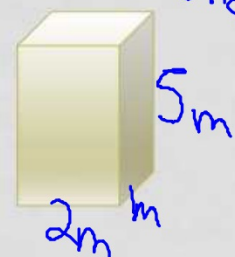
$$A = s^2$$
$$P = 4s$$


$$A = \pi r^2$$
$$C = 2\pi r$$

- Volumes of cubes and basic prisms


$$V = s^3$$

$$V = 2 \times 1 \times 5$$
$$V = 10 \text{ m}^3$$



ESTIMATION

- Purpose: When you estimate a quantity or a measurement, you are ROUNDING TO LESS S.F., not changing your answer. You do this, to check how reasonable is your answer, or to simply get an idea of the approximate value of the answer to make sure it makes sense.
- How do you *Estimate*? More than 1s.f to 1 s.f.
 - Example: 123 meters \rightarrow 100

Use common sense as well. The point is to make the calculation easier!
(see next example)

EXAMPLES

Example 14

A theatre has 98 rows; each row has 23 seats. Estimate the number of seats in the theatre.

Answer

$$100 \times 20 = 2000 \text{ seats}$$

Round 98 to 1sf \rightarrow 100

Round 23 to 1sf \rightarrow 20

Example 15

Estimate the average speed of a car that travels 527km in 6 hours.

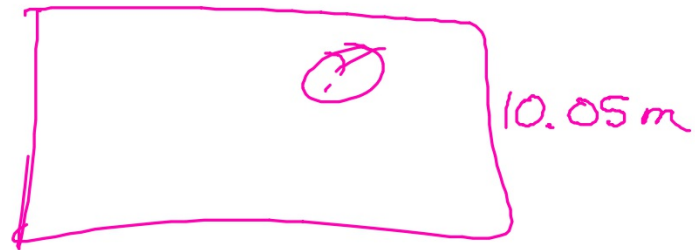
Answer

$$\text{Average speed} = \frac{\text{distance traveled}}{\text{time taken}}$$

$$\frac{500}{5} = 100 \text{ km h}^{-1}$$

527 \rightarrow 500 (1sf)

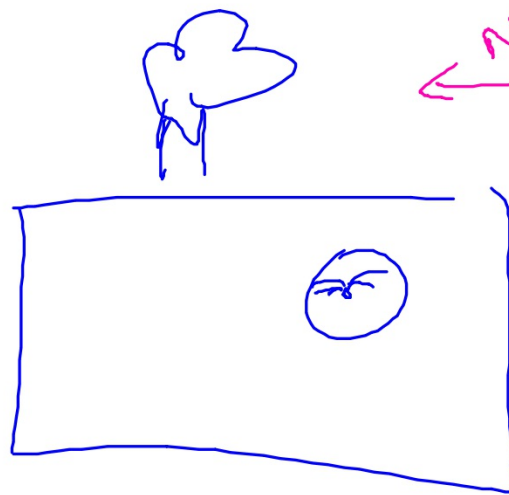
Round 6 down to 5 to make the division calculation easier.



Fares $\Rightarrow 10.47 \text{ m}$

$$\text{error} = |10.05 - 10.47|$$

$$\frac{0.42}{10.05} = 0.042 \times 100 = 4.2\%$$



$$-1.52 < 0.48$$

$$\text{but } |-1.52| > |0.48|$$

31.52 m

$\Rightarrow 4.82\%$

Federico $\Rightarrow 30 \text{ m} \Rightarrow -1.52$

Fleur $\Rightarrow 32 \text{ m} \Rightarrow 0.48$

$$\frac{0.48}{31.52} = 0.0152$$

$$1.52\%$$

PERCENTAGE ERROR

- What is error? Don't forget it is not a mistake
It means \Rightarrow Not exact
- What is percentage error? Don't forget % and The Absolute value bars.

$$\varepsilon = \frac{|v_A - v_E|}{v_E} \times 100\%$$

where v_E is the exact value and v_A is the approximate value.

$$\% \text{ error} = \frac{\text{Value approx} - \text{exact value}}{\text{exact value}} \times 100$$

If no bars, you get -1 point

2 KIND OF EXAMPLES

1. Estimation:

- You estimate a fence's length to be 70 m and when you measure it, its true length is 78.3 m.

$$\begin{aligned} \% \text{ error} &= \frac{|70 - 78.3|}{78.3} \times 100 \\ &= 10.6\% \end{aligned}$$

2. Rounding:

- Suppose we are rounding a crowd size of 45,471 to 45,000.

$$\begin{aligned} \% \text{ error} &= \frac{|45000 - 45471|}{45471} \times 100 \\ \% \text{ error} &= 1.04\% \end{aligned}$$

IB STYLE QUESTIONS

- Omar needs to pack his room. He buys a box and he estimates the width, length and height to be 50 cm, 1.0 m, 80 cm respectively. He then decides to measure it exactly and he finds that it measures 52 cm X 1.1 m X 77 cm. Calculate the % error of the estimated volume?

$$50 \text{ cm}, 100 \text{ cm}, 80 \text{ cm}$$

$$(0.5 \text{ m}, 1 \text{ m}, 0.8 \text{ m})$$

$$V_{\text{estimate}} = 50 \times 100 \times 80$$

$$= 400000 \text{ cm}^3$$

$$V_{\text{exact}} = 52 \times 110 \times 77$$

$$= 440440 \text{ cm}^3$$

$$\% \text{ error} = \frac{|400000 - 440440|}{440440} \times 100 = 9.18\%$$

IB STYLE QUESTIONS

Let $a = 2.13$ and $b = 51.2$

- a) Calculate the **exact** value of $4a + b^2 = 2629.96$ Note: Here you CANNOT round, they have asked for the exact answer!

b) Write your answer to part a) correct to:

i) 1 decimal place

ii) 2 significant figures

Antonio estimates that the value of $4a + b^2$ is 2500.

- c) Find the percentage error made by Antonio.

$$\% \text{ error} = \frac{|2500 - 2629.96|}{2629.96} \times 100$$

Don't forget the abs. value bars

$$\% \text{ error} = 4.94\%$$

Answer should be given to 3s.f. unless otherwise specified.