Worksheet - Units, estimation, rounding and bounds

Year: Year 10 · 20

Show your working.

Question 1

Question 1 – Metric conversions *(Section A · Skills practice)*

Non-calculator. Convert each measurement. Remember to square or cube the conversion factor for areas and volumes.

a. 3.5 km into metres
b. 2500 ml into litres
c. 0.8 tonnes into kilograms
d. $4.5\ \text{m}^2$ into cm²

Question 2

Question 2 – Rounding *(Section A · Skills practice)*

Round each number as asked.

a. 4.2679 to 2 decimal places and to 3 significant figures
b. 0.004567 to 2 significant figures
c. 25 489 to 3 significant figures and to the nearest hundred
d. 7.996 to 1 decimal place and to 2 significant figures

Question 3

Question 3 – Estimating *(Section A · Skills practice)*

Round each number to 1 significant figure to estimate the value. Show your working.

a. 4.8×19.7
b. $\dfrac{304}{0.52}$
c. $\dfrac{58.7 \times 0.41}{0.19}$
d. $\sqrt{82} + \sqrt{26}$ (use nearby square numbers)

Question 4

Question 4 – Error intervals *(Section A · Skills practice)*

Write the error interval for each rounded value, using inequalities $a \leq x < b$.

a. $x = 7.3$ rounded to 1 decimal place
b. $x = 450$ rounded to 2 significant figures
c. $x = 12$ rounded to the nearest whole number
d. $x = 3.4$ truncated to 1 decimal place

Question 5

Question 5 – Upper and lower bounds *(Section A · Skills practice)*

Write down the lower bound and the upper bound for each measurement.

a. A length of 8.4 cm, measured to the nearest 0.1 cm
b. A mass of 250 g, measured to the nearest 10 g
c. A time of 12.3 s, measured to 1 decimal place
d. A capacity of 2.5 litres, measured to 2 significant figures

Question 6

Question 6 – Time and everyday units *(Section A · Skills practice)*

Non-calculator unless stated.

a. Write 2 hours 15 minutes as a decimal number of hours.
b. A car travels 5 miles. Use 5 miles $\approx$ 8 km to estimate 35 miles in km.
c. Calculator: 3.5 kg in pounds, using 1 kg = 2.2 lb.
d. A film lasts 1.4 hours. Write this in hours and minutes.

Question 7

Question 7 – A ream of paper *(Section B · Real-life practice)*

A pack of printer paper has 500 sheets and is 5 cm thick (to the nearest cm). Calculator allowed.

a. Find the thickness of one sheet in mm.
b. What are the least and greatest possible thicknesses of the pack?
c. Use these to find the least and greatest possible thickness of one sheet in mm, to 3 decimal places.
d. A school buys 120 packs. Estimate the height of all of them in one stack, in metres.

Question 8

Question 8 – The 100 m sprint *(Section B · Real-life practice)*

Aisha runs 100 m in 12.3 seconds. The distance is exact and the time is measured to the nearest 0.1 s. Calculator allowed.

a. Find her average speed in m/s to 2 decimal places.
b. Write the lower and upper bounds of her time.
c. Find the greatest and least possible average speed.
d. Can her speed be given correct to 2 significant figures with certainty? What about 1 significant figure?

Question 9

Question 9 – Carpet for the lounge *(Section B · Real-life practice)*

A lounge floor is measured as 4.2 m by 3.8 m, each to 1 decimal place. Carpet costs £18 per m².

a. Work out the area from the measurements.
b. Find the lower and upper bounds of the area.
c. Find the greatest possible cost.
d. Mr Khan buys exactly 16.4 m² of carpet. Is that certainly enough? Explain.

Question 10

Question 10 – Crowd estimate *(Section B · Real-life practice)*

A football stadium has 12 sections. A steward counts about 480 people in a typical section of 1 row of one block and there are about 9 rows in each section.

a. Estimate the crowd by rounding to 1 significant figure.
b. Write your estimate in standard form.
c. The stadium capacity is 5.2×10^4. What percentage of seats might be filled? Give your answer to the nearest 1%.
d. Is your estimate an overestimate or underestimate? Explain.

Question 11

Question 11 – Cooking in different units *(Section B · Real-life practice)*

An American recipe uses pounds and fluid ounces. Use 1 lb ≈ 454 g, 1 oz ≈ 28.4 g and 1 fl oz ≈ 28.4 ml. Calculator allowed.

Ingredient	US amount
Flour	2 lb
Butter	6 oz
Milk	10 fl oz

a. Convert the flour to grams.
b. Convert the butter to grams.
c. Convert the milk to millilitres and to litres.
d. A UK cook has 1 kg of flour. How many pounds is that? Give your answer to 1 d.p.

Question 12

Question 12 – Tiling the bathroom wall *(Section B · Real-life practice)*

A bathroom wall is 2.4 m wide and 1.8 m high. Square tiles of side 15 cm are used. A box holds 20 tiles. Calculator allowed.

a. Convert the dimensions of the wall to centimetres.
b. How many tiles fit across and up? Do they fit exactly?
c. How many boxes must be bought?
d. The tiles cost £24 a box. Find the cost and the percentage of the tiles bought that are left over.

Question 13

Question 13 – Medicine doses *(Section B · Real-life practice)*

A doctor prescribes 5 ml of medicine to the nearest millilitre, taken 3 times a day for 7 days. A bottle contains 100 ml.

a. Work out the error interval for one dose.
b. Find the least and greatest total medicine needed in 7 days.
c. Is one bottle certainly enough? Explain.
d. The dose is 5 ml from a spoon marked in 5 ml steps. Why might this be a better measure than 4.5 ml?

Question 14

Question 14 – Rounding in real life *(Section B · Real-life practice)*

Decide how each answer should be rounded in its context, and explain your choice.

a. A class of 28 pupils goes on a trip in minibuses that each take 8 people. How many minibuses are needed?
b. A tin of paint covers 12 m². A wall has area 50 m². How many tins must be bought?
c. A fuel bill is £47.3846. How much is paid?
d. A city has a population of 8 982 412. Write it to 2 significant figures in standard form.

Question 15

Question 15 – Higher: bounds in calculations *(Section C · Problem solving)*

Higher tier. $a = 6.5$ and $b = 2.4$, both rounded to 1 decimal place.

a. Write the bounds of a and b.
b. Find the upper bound of $a + b$ and the lower bound of $a - b$.
c. Find the upper bound of $\frac{a}{b}$ to 3 decimal places.

d. Find the lower bound of ab.

Question 16

Question 16 – Higher: a speed with uncertain data *(Section C · Problem solving)*

Higher tier. A coach travels 120 km (to the nearest 10 km) in 1.5 hours (to 1 decimal place).

a. Write the bounds of the distance and the time.
b. Find the greatest possible average speed, to 1 decimal place.
c. Find the least possible average speed, to 1 decimal place.
d. Can the speed be given correct to 1 significant figure? Explain.

Question 17

Question 17 – Higher: area of a circle *(Section C · Problem solving)*

Higher tier. A circular table has a diameter of 10 cm, measured to the nearest centimetre.

a. Write the bounds of the diameter and the radius.
b. Find the upper and lower bounds of the area, in terms of π and as decimals to 1 d.p.
c. The area is quoted as 78.5 cm². Explain why this accuracy is unjustified.
d. To what accuracy (number of significant figures) can the area be quoted with certainty?

Question 18

Question 18 – Truncating and rounding *(Section C · Problem solving)*

A calculator shows 3.14159265... for π.

a. Round π to 2 decimal places and give the error interval for this rounded value.
b. Truncate π to 2 decimal places and give the error interval for the truncated value.
c. Which is closer to the true value?
d. A student truncates 4.99 to 1 decimal place. What do they get, and how different is it from rounding?

Question 19

Question 19 – Percentage error *(Section C · Problem solving)*

A scientist measures a metal rod as 24.6 cm, to the nearest 0.1 cm. The true length is later found to be 24.63 cm.

a. Find the absolute error of the measurement.
b. Express the error as a percentage of the true length, to 2 decimal places.

c. What is the greatest possible error in the measurement (half the unit)?
d. Express this greatest error as a percentage of 24.6 cm to 2 decimal places.

Question 20

Question 20 – Challenge: how accurate is the area? *(Section D · Challenge)*

The side of a square is 3.45 cm to 2 decimal places.

a. Write the bounds of the side.
b. Find the bounds of the area to 4 decimal places.
c. To how many significant figures can the area be quoted with certainty?
d. State the area to that accuracy.