

C1.9 Estimation

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS significant figure 有效数字 • estimate 估算 • decimal place 小数位 • rate 比率
• decimal 小数

Objective

Use estimation to solve Core IGCSE Mathematics problems.

You must be able to:

- Round to a stated decimal place or significant figure
- Estimate a calculation before checking it
- Round discrete quantities in the direction required by context

1 Key knowledge and worked examples

■ Key knowledge: Estimation

For decimal places, count digits after the point. For significant figures, start at the first nonzero digit. Inspect the next digit: 5 or more rounds up. Estimate by rounding each input, usually to one significant figure, before calculating. Keep full values for an accurate calculation and round only its final result. Context can require rounding up, such as the number of buses needed.

■ Worked example: Estimation

0.006739	first digit: 6	2 sf: 0.0067
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Estimate $59.2 \times 3.86 / 0.21$.

- Round inputs to one significant figure: $59.2 \approx 60$, $3.86 \approx 4$, $0.21 \approx 0.2$.
- Estimate: $Q \approx (60 \times 4) / 0.2 = 1200$.
- 0.007846 to two significant figures is 0.0078; the next digit is 4.
- If 101 people need buses of capacity 40, $B = 101/40 = 2.525$; the minimum is 3 buses. Rounding to the nearest integer would leave people behind.

■ Method check

An estimate checks plausibility rather than replacing an accurate calculation. A minimum number of buses or packs must be rounded up.

2 Practice

2.1 Round 8634 to the nearest thousand. [2]

2.2 Round 4.276 to two decimal places. [2]

2.3 Round 0.006739 to two significant figures. [2]

2.4 Estimate $48.1 \div 9.7$ using one significant figure for each number. [2]

3 Exam-style questions

3.1 Apply the estimation methods below. Show working and include units where appropriate.

(a) Estimate $19.6 \times 5.12 \div 0.49$ using one significant figure for each number. [2]

(b) Calculate its accurate value to three significant figures. [2]

(c) A bus holds 48 people. Find the minimum number of buses needed for 205 people.[2]

3.2 A floor has area 18.7 m^2 . Each box covers 0.48 m^2 and costs 31.60 yuan.

(a) Estimate the box count using 20 m^2 and 0.5 m^2 . Then find the minimum whole number of boxes actually needed. [3]

(b) Find the actual total cost and explain why buying only 38 boxes would be insufficient. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- The hundreds digit is 6, so round up: **9000**.

2.2

- The third decimal digit is 6, so **4.28**.

2.3

- The significant digits begin at 6; the next after 7 is 3, so **0.0067**.

2.4

- $Q \approx 50/10 = \mathbf{5}$.

3.1

(a)

- $Q \approx (20 \times 5)/0.5 = \mathbf{200}$.

(b)

- $Q = (19.6 \times 5.12)/0.49 = 204.8$, so **205** to three significant figures.

(c)

- $B = 205/48 = 4.2708\dots$; round up to **5 buses**, because four carry only 192.

3.2

(a)

- Estimate $N_e = 20/0.5 = \mathbf{40}$ boxes.
- Actual $N = 18.7/0.48 \approx 38.9583$, so buy **39 boxes**.

(b)

- Use $C = Nc = 39(31.60)$, giving $C = \mathbf{1232.40}$ yuan.
- Only 38 boxes cover $A = 38(0.48) = 18.24 \text{ m}^2$, less than 18.7 m^2 , so 38 are insufficient.