

# Estimation

## Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

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Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

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**1** (2 marks)

Round 68 and 31 to the nearest 10

Use your rounded numbers to estimate the value of  $68 \times 31$

Round each number to the nearest 10:

$$68 \approx 70$$

$$31 \approx 30$$

$$70 \times 30 = 2100$$

(Think:  $7 \times 3 = 21$ , then put the two zeros back on.)

**Answer:** 2100

**Tip:** An estimate means round first, then work it out. Working out  $68 \times 31$  exactly gets no marks.

*Marks:* 1 mark for  $70 \times 30$ . 1 mark for 2100.

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**2** (1 mark)

Circle the best estimate of  $\frac{49.6 \times 3.1}{0.52}$

Options: 30, 75, 300, 3000

Round each number to 1 significant figure:

$$49.6 \approx 50, 3.1 \approx 3, 0.52 \approx 0.5$$

$$\text{Top: } 50 \times 3 = 150$$

Dividing by 0.5 is the same as multiplying by 2.

$$150 \div 0.5 = 300$$

**Answer:** 300

**Tip:** Round 0.52 to 0.5, not to 1 or 0. Dividing by 0.5 makes the answer **bigger**.

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**3** (2 marks)

Use approximations to estimate the value of  $\sqrt{63.7} \times 4.9$

63.7 is close to 64, which is a square number.

$$\sqrt{64} = 8$$

$$4.9 \approx 5$$

$$8 \times 5 = 40$$

**Answer:** 40

**Tip:** Under a square root, round to the nearest square number (64), not to 1 significant figure (60).

*Marks:* 1 mark for  $\sqrt{64}$  and 5. 1 mark for 40.

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**4** (2 marks)

Pens cost £2.95 each.

Jenny buys 19 pens.

Estimate the total cost.

Round each number:

$$£2.95 \approx £3$$

$$19 \approx 20$$

$$20 \times 3 = 60$$

**Answer:** about £60

*Marks:* 1 mark for  $20 \times 3$ . 1 mark for £60.

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**5** (2 marks)

Sid works out  $\frac{396}{19.8}$   
He gets 200

Is his answer sensible? Tick a box.  
Show how you decide.

Round each number to 1 significant figure:

$$396 \approx 400$$

$$19.8 \approx 20$$

$$400 \div 20 = 20$$

The answer should be about 20.

200 is ten times too big, so it is not sensible.

**Answer:** No, an estimate is 20

*Marks:* 1 mark for an estimate (e.g.  $400 \div 20 = 20$ ). 1 mark for No, based on your estimate.

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**6** (2 marks)

An approximation for the value of  $\pi$  is 3  
Use this to estimate the area of a circle of radius 9.8 cm.

$$\text{Area of a circle} = \pi r^2$$

Use  $\pi \approx 3$  and  $r = 9.8 \approx 10$ .

$$3 \times 10^2 = 3 \times 100 = 300$$

**Answer:** 300 cm<sup>2</sup>

*Marks:* 1 mark for  $3 \times 10^2$ . 1 mark for 300.

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**7** (4 marks)

- (a) Work out an estimate for  $\frac{612 \times 4.12}{0.198}$

Round each number to 1 significant figure:

$$612 \approx 600, 4.12 \approx 4, 0.198 \approx 0.2$$

$$\text{Top: } 600 \times 4 = 2400$$

Dividing by 0.2 is the same as multiplying by 5.

$$2400 \div 0.2 = 12\,000$$

**Answer:** 12 000

*Marks:* 1 mark for 600, 4 and 0.2. 1 mark for 2400 or dividing by 0.2. 1 mark for 12 000.

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

612 and 4.12 were rounded down, so the top of the fraction got smaller.

0.198 was rounded up, so we divided by a bigger number.

Both of these make the answer smaller.

So the estimate is an underestimate.

**Answer:** Underestimate: the numerator was rounded down and the denominator rounded up

**Tip:** Talk about each number you rounded, not just “I rounded down”. Rounding the bottom of a fraction **up** makes the answer **smaller**.

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**8** (2 marks)

Round each number to 1 significant figure to estimate

$$4.18^2 - 29.6 \div 5.23$$

Round each number to 1 significant figure:

$$4.18 \approx 4, 29.6 \approx 30, 5.23 \approx 5$$

$$4^2 - 30 \div 5$$

Do the power and the division before subtracting:

$$16 - 6 = 10$$

**Answer:** 10

**Tip:** Follow the order of operations: work out  $30 \div 5$  first. Doing  $16 - 30$  first and then dividing by 5 is a common mistake.

*Marks:* 1 mark for 4, 30 and 5. 1 mark for 10.

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**9** (3 marks)

A bag contains 4.9 kg of rice.

Chen uses 98 g of rice each day.

Estimate how many days the bag of rice will last.

You must show your working.

The units must match. Change kg to g:

$$4.9 \text{ kg} \approx 5 \text{ kg} = 5000 \text{ g}$$

$$98 \text{ g} \approx 100 \text{ g per day}$$

$$\text{Number of days: } 5000 \div 100 = 50$$

**Answer:** about 50 days

*Marks:* 1 mark for changing kg to g (or g to kg). 1 mark for rounding to 5000 and 100 (or 5 and 0.1). 1 mark for 50.

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**10** (3 marks)

Kai uses his calculator to work out  $\frac{812 - 395}{3.9 \times 5.2}$   
The calculator display shows 2.056213018

Use approximations to show that Kai must have pressed a wrong key.  
You must show your working.

Round each number to 1 significant figure:

$$812 \approx 800, 395 \approx 400, 3.9 \approx 4, 5.2 \approx 5$$

$$\text{Top: } 800 - 400 = 400$$

$$\text{Bottom: } 4 \times 5 = 20$$

$$400 \div 20 = 20$$

An estimate is 20, but the calculator shows about 2.

The display is about ten times too small, so Kai must have pressed a wrong key.

(The accurate answer is 20.56 ...)

**Tip:** Work out the whole top and the whole bottom before dividing. Finish with a sentence that compares your estimate with the calculator display.

*Marks:* 1 mark for 800, 400, 4 and 5. 1 mark for  $400 \div 20$ . 1 mark for 20 and comparing it with 2.056 ...

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