

# Estimation

## Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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** (3 marks)

Work out an estimate for the value of  $\frac{8.21 \times 39.6}{0.49}$

Round each number to 1 significant figure:

$$8.21 \approx 8, \quad 39.6 \approx 40, \quad 0.49 \approx 0.5$$

$$\text{Top: } 8 \times 40 = 320$$

Dividing by 0.5 is the same as multiplying by 2.

$$320 \div 0.5 = 640$$

**Answer:** 640

**Tip:** Round 0.49 to 0.5, not to 0 or 1. Dividing by 0.5 doubles the number, so  $320 \div 0.5$  is 640, not 160.

*Marks:* 1 mark for 8, 40 and 0.5. 1 mark for 320 or dividing by 0.5. 1 mark for 640.

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**2** (2 marks)

Work out an estimate for the value of  $\frac{\sqrt{99.2}}{2.03^2}$

99.2 is close to 100, which is a square number.

$$\sqrt{100} = 10$$

$$2.03 \approx 2, \text{ so } 2.03^2 \approx 2^2 = 4$$

$$10 \div 4 = 2.5$$

**Answer:** 2.5

*Marks:* 1 mark for  $\sqrt{100}$  and  $2^2$ . 1 mark for 2.5.

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**3** (2 marks)

Use  $\pi \approx 3$  to estimate the circumference of a circle with diameter 19.7 cm.

Circumference =  $\pi \times$  diameter

Use  $\pi \approx 3$  and  $19.7 \approx 20$ .

$$3 \times 20 = 60$$

**Answer:** 60 cm

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

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**4** (2 marks)

A car travels 297 miles on 11.2 gallons of petrol.

Estimate the number of miles the car travels on 1 gallon.

Miles per gallon = miles  $\div$  gallons

Round each number to 1 significant figure:

$$297 \approx 300, 11.2 \approx 10$$

$$300 \div 10 = 30$$

**Answer:** about 30 miles

*Marks:* 1 mark for  $300 \div 10$ . 1 mark for 30.

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**5** (2 marks)

Pete buys 41 packets of crisps at 48p each.

He estimates the total cost is £30

Is Pete's estimate sensible?

You must show how you get your answer.

Round each number:

$$41 \approx 40, 48\text{p} \approx 50\text{p}$$

$$40 \times 50 = 2000\text{p}$$

$$2000\text{p} = £20$$

A sensible estimate is £20, so £30 is too high.

**Answer:** No, a good estimate is £20

**Tip:** Watch the units: 2000p is £20, not £2000. Divide pence by 100 to get pounds.

*Marks:* 1 mark for  $40 \times 50$  (or  $40 \times 0.5$ ). 1 mark for saying No, with £20.

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**6** (2 marks)

Estimate the number of hours in a year.

You must show your working.

There are 365 days in a year and 24 hours in a day.

$$\text{Hours in a year} = 365 \times 24$$

$$\text{Round: } 365 \approx 400 \text{ and } 24 \approx 20$$

$$400 \times 20 = 8000$$

(Other sensible roundings are fine. For example,  $400 \times 25 = 10\,000$ .)

**Answer:** about 8000 to 10 000

*Marks:* 1 mark for rounding 365 and 24 and multiplying. 1 mark for a correct answer for your rounding.

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**7** (4 marks)

Laura is tiling a floor with an area of  $19.6 \text{ m}^2$ .  
She needs 25 tiles for each  $\text{m}^2$ .  
Each tile costs 98p.

- (a) Work out an estimate for the total cost of the tiles.  
You must show your working.

Round the area:  $19.6 \approx 20 \text{ m}^2$

She needs 25 tiles for each  $\text{m}^2$ :  $20 \times 25 = 500$  tiles

Round the price:  $98\text{p} \approx 100\text{p} = \text{£}1$

Cost:  $500 \times 1 = 500$ , so about  $\text{£}500$

**Answer:**  $\text{£}500$

**Tip:** Change pence to pounds: 500 tiles at 100p is 50 000p, which is  $\text{£}500$ .

*Marks:* 1 mark for rounding 19.6 to 20 and 98p to  $\text{£}1$ . 1 mark for  $20 \times 25 (= 500 \text{ tiles})$ . 1 mark for  $\text{£}500$ .

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

19.6 was rounded **up** to 20, so we used a bigger area than the real one.

98p was rounded **up** to  $\text{£}1$ , so we used a higher price than the real one.

Both of these make the cost bigger.

The estimate is an overestimate.

**Answer:** Overestimate: the area and the price were both rounded up

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**8** (4 marks)

A ferry sails across a lake for 41 minutes.  
Its average speed is  $31.8 \text{ km/h}$ .

- (a) Work out an estimate for the distance the ferry sails.  
You must show your working.

Distance = speed  $\times$  time

Round:  $31.8 \approx 30$  km/h and  $41 \approx 40$  minutes

Change the time to hours:  $40 \text{ minutes} = \frac{40}{60} = \frac{2}{3}$  of an hour

$$30 \times \frac{2}{3} = 20$$

**Answer:** 20 km

**Tip:** The speed is in km per **hour**, so the time must be in hours. Working out  $30 \times 40 = 1200$  is a common mistake.

*Marks:* 1 mark for rounding to 30 and 40. 1 mark for  $30 \times \frac{40}{60}$  (or 30 km in 60 minutes, so 10 km every 20 minutes). 1 mark for 20.

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

31.8 was rounded down, so the speed used is too small.

41 was rounded down, so the time used is too short.

Both of these make the distance smaller.

So the estimate is an underestimate.

**Answer:** Underestimate: the speed and the time were both rounded down

**Tip:** Mention **both** roundings and what each one does to the answer.

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**9** (4 marks)

Amir has £300 to spend on plants for his garden.

He buys 38 plants.

Each plant costs £5.90

- (a) Work out an estimate for the amount of money Amir has left.  
You must show all your working.

Round each number to 1 significant figure:

$$38 \approx 40 \text{ and } £5.90 \approx £6$$

$$\text{Cost of the plants: } 40 \times 6 = 240$$

£300 is already a round number, so use it as it is.

Money left =  $300 - 240 = 60$

**Answer:** £60

**Tip:** Read the question: it asks for the money **left**, so take the cost away from £300.

*Marks:* 1 mark for rounding to 40 and 6. 1 mark for  $40 \times 6 (= 240)$ . 1 mark for £60.

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

38 and £5.90 were both rounded up, so the cost used is too big.

Taking away too much makes the money left smaller.

So the estimate is an underestimate.

**Answer:** Underestimate: the number of plants and the price were both rounded up, so the cost used was too big

**Tip:** Rounding a cost **up** makes the money left **smaller**. Think about what each rounding does to the answer.

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