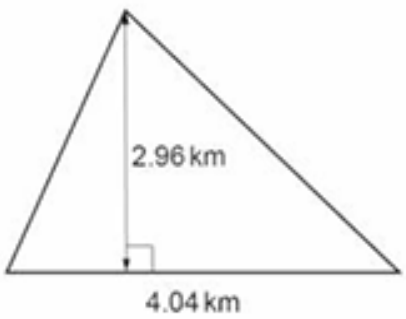
1. A housing estate is built on a triangular piece of land.



Not to scale

There are 8947 people living on the estate.

Work out an **estimate** of the population density of the estate in people per km^2.

..... people per km^2 **[4]**

2. A water company is laying pipes to cover a distance of 102 metres, correct to the nearest metre.
Each pipe has a length of 2.4 metres, correct to 1 decimal place.
Assume the pipes are laid end to end with no gaps or overlaps.

Work out the minimum number of pipes the water company needs to be sure of covering that distance.
You must show your working.

..... **[4]**

3(a). A lift can travel at a maximum speed of 9.78 m/s, correct to 3 significant figures.
The lift travels a distance of 192m, correct to the nearest metre, between the ground floor and the top floor of a building.

Use the above information to work out the shortest possible time for the lift to travel between the ground floor and the top floor.
You must show your working.

..... s **[4]**

(b). Explain why your answer to **part (a)** may not be possible to achieve.

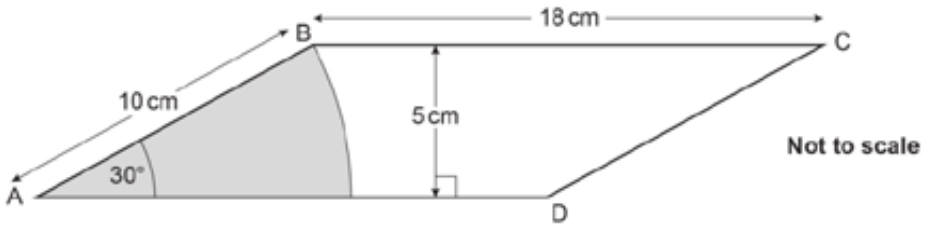
---**[1]**

4. An aluminium photo frame has a volume of 497 cm^3.
The density of aluminium is 2.7 g/cm^3.

By rounding each value correct to one significant figure, work out an estimate for the mass of the aluminium photo frame.

..... g **[3]**

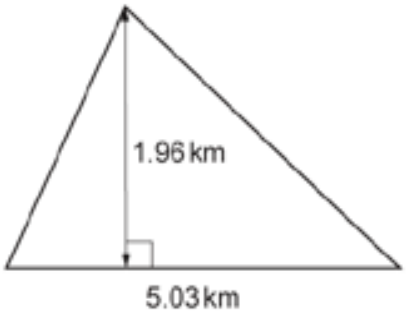
5. The diagram shows a shaded sector inside a parallelogram.
The sector has an angle of 30°.
The parallelogram, ABCD, has length BC = 18 cm and AB = 10 cm.
The perpendicular distance between BC and AD is 5 cm.



Show that the area of the sector is 26.2 cm^2, correct to **3** significant figures.

[3]

6. A housing estate is built on a triangular piece of land.



Not to scale

There are 3951 people living on the estate.

Work out an **estimate** of the population density of the estate in people per km^2.

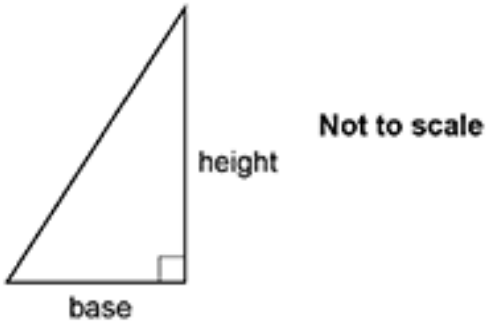
..... people per km^2 **[4]**

7. A water company is laying pipes to cover a distance of 37 metres, correct to the nearest metre.
Each pipe has a length of 2.3 metres, correct to 1 decimal place.
Assume the pipes are laid end to end with no gaps or overlaps.

Work out the minimum number of pipes the water company needs to be sure of covering that distance.
You must show your working.

..... **[4]**

8. Here is a right-angled triangle.



The area of the triangle is 110 cm^2, correct to the nearest 10 cm^2.
The height of the triangle is 7 cm, correct to the nearest cm.

Calculate the smallest possible length of the base of the triangle.

..... cm **[4]**

9. Solve this equation algebraically.
Give your answers correct to **2** decimal places.
You must show your working.

$x^2 - 7x + 4 = 0$

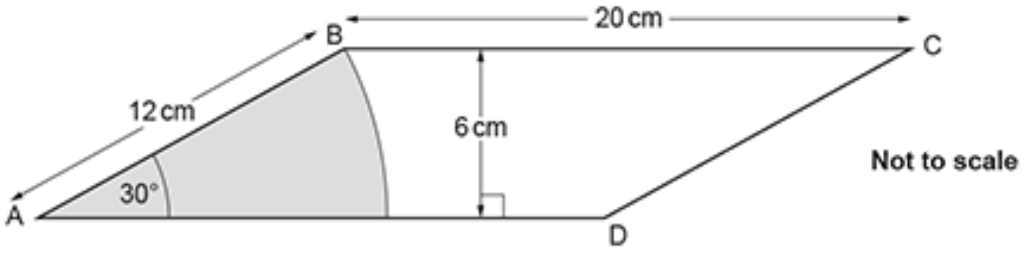
x = ... or x = ... **[4]**

10. By writing each number correct to **1** significant figure, find an estimate for this calculation.

$$\frac{689}{\sqrt{104.3}}$$

..... **[2]**

11. The diagram shows a shaded sector inside a parallelogram.
The sector has an angle of 30°.
The parallelogram, ABCD, has length BC = 20cm and AB = 12cm.
The perpendicular distance between BC and AD is 6 cm.



Show that the area of the sector is 37.7cm^2, correct to **3** significant figures.

[3]

12. A bronze ornament has a volume of 198 cm^3.
The density of bronze is 8.9 g/cm^3.

By rounding each value correct to one significant figure, work out an estimate for the mass of the bronze ornament.

.....g **[3]**

13(a). A lift can travel at a maximum speed of 9.83 m / s, correct to 3 significant figures.
The lift travels a distance of 174 m, correct to the nearest metre, between the ground floor and the top floor of a building.

Use the above information to work out the shortest possible time for the lift to travel between the ground floor and the top floor.
You must show your working.

..... s **[4]**

(b). Explain why your answer to **part (a)** may not be possible to achieve.

---

[1]

14. A plane flies from London to Singapore.
The distance is 10 800 km, correct to the nearest 100 km.
The plane travels at an average speed of 830 km/h, correct to the nearest 10 km/h.

Calculate the shortest possible flight time of the plane.
Give your answer in hours and minutes, correct to the nearest minute.
You must show your working.

…… hours …… minutes **[5]**

15(a). A box contains 300 matches, correct to the nearest ten matches.

Complete the error interval for n, the number of matches in the box.

..... ≤ n ≤ ..... **[2]**

(b). The box is a cuboid with

- length 8 cm, correct to the nearest cm
- width 6 cm, correct to the nearest cm
- volume 332 cm^3, correct to the nearest cm^3.

Show that the smallest possible height of the box is 6 cm.

[3]

16. The circumference of a circle is 32 cm.

Show that the area of the circle is 81.5 cm^2, correct to **3** significant figures.

[4]

17. A car accelerates at 6.08 m/s^2 for 10.3 seconds from an initial velocity of 4.92 m/s.

Amaya rounds each value to 1 significant figure.
Amaya uses the rounded values and the formula

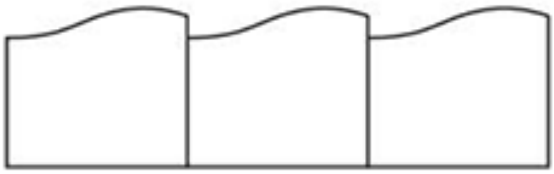
$$s = ut + \frac{1}{2}at^2$$

to estimate the distance travelled in the 10.3 seconds.
Amaya's answer is 250 metres.

Using Amaya's method, show that their answer is wrong.

[4]

18. Li buys fence panels that fit tightly together.



Each panel has a length of 1.8 m, correct to 1 decimal place.
Li measures the length of a garden as 32 m, correct to the nearest metre.

Work out the minimum number of panels Li should buy in order to be certain that there are enough panels for the length of the garden.
Show how you decide.

…… **[4]**

19(a). The width, *w*, of a kitchen cupboard is 80 cm, correct to the nearest centimetre.

Complete the error interval for the width, *w*.

..... ≤ *w* < ..... **[2]**

(b). Six of these kitchen cupboards are to be placed side by side along a kitchen wall.
The wall is 483 cm long, correct to the nearest centimetre.

i. Show that the six cupboards may **not** fit along the wall.

[3]

ii. Find the upper bound of the space remaining if six cupboards do fit along the wall.

..... cm **[3]**

20. The formula

$P = 8500 \times 1.054^n$

is used to predict the population, P, of an island n years after 2019.

i. Work out the population predicted by the formula for the year 2030.

…….…….…….. **[2]**

ii. Give one reason why the answer to **(i)** may **not** be reliable.

---**[1]**

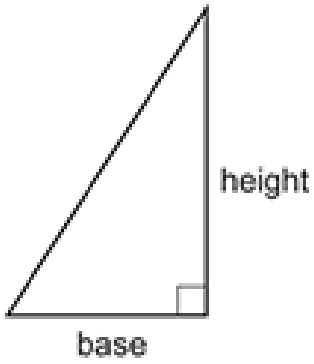
21. Calculate.

$$\sqrt{\frac{8.9^2 + 1.4^2}{5.5 - 3.1}}$$

Write your answer correct to **3** significant figures.

..... **[3]**

22. Here is a right-angled triangle.



Not to scale

The area of the triangle is 100cm^2, correct to the nearest 10cm^2.
The length of the base of the triangle is 8 cm, correct to the nearest cm.

Calculate the largest possible height of the triangle

..... cm **[4]**

23. Solve this equation algebraically.
Give your answers correct to **2** decimal places.
You must show your working.
$x^2 - 5x + 3 = 0$

x = ... or x = ... **[4]**

24. By writing each number correct to **1** significant figure, find an estimate for this calculation.

$$\frac{486}{\sqrt{101.2}}$$

..... **[2]**

25(a). A box contains 200 matches, correct to the nearest ten matches.

Complete the error interval for n, the number of matches in the box.

..... ≤ n ≤ ..... **[2]**

(b). The box is a cuboid with

- length 7 cm, correct to the nearest cm
- width 5 cm, correct to the nearest cm
- volume 248 cm^3, correct to the nearest cm^3.

Show that the smallest possible height of the box is 6 cm.

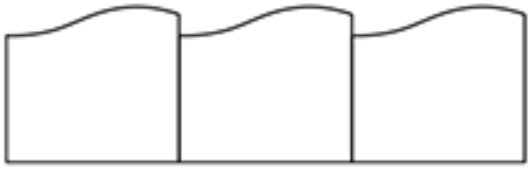
[3]

26. A plane flies from London to Tokyo.
The distance is 9600 km, correct to the nearest 100 km.
The plane travels at an average speed of 820 km/h, correct to the nearest 10 km/h.

Calculate the shortest possible flight time of the plane.
Give your answer in hours and minutes, correct to the nearest minute.
You must show your working.

..... hours ..... minutes **[5]**

27. Jamie buys fence panels that fit tightly together.



Each panel has a length of 1.8 m, correct to 1 decimal place.
Jamie measures the length of a garden as 42 m, correct to the nearest metre.

Work out the minimum number of panels Jamie should buy in order to be certain that there are enough panels for the length of the garden.
Show how you decide.

..... **[4]**

28. The circumference of a circle is 23 cm.

Show that the area of the circle is 42.1 cm^2, correct to **3** significant figures. **[4]**

29. A car accelerates at 4.06 m/s^2 for 10.1 seconds from an initial velocity of 2.93 m/s.

Harper rounds each value to 1 significant figure.
Harper uses the rounded values and the formula

$$s = ut + \frac{1}{2}at^2$$

to estimate the distance travelled in the 10.1 seconds.
Harper's answer is 430 metres.

Using Harper's method, show that their answer is wrong. **[4]**

30. This table shows the names and areas of five lakes.

Name of Lake	Area in km^2
Ladoga	1.81×10^4
Mweru	5.12×10^3
Tana	3.20×10^3
Topozero	9.86×10^2
Victoria	6.89×10^4

Calculate the difference between the areas of Lake Ladoga and Lake Tana.
Give your answer in standard form, correct to **2** significant figures.

..... km^2 **[4]**

31(a). The width, *w*, of a kitchen cupboard is 60 cm, correct to the nearest centimetre.

Complete the error interval for the width, *w*.

..... ≤ w < ..... **[2]**

(b). Six of these kitchen cupboards are to be placed side by side along a kitchen wall.
The wall is 363 cm long, correct to the nearest centimetre.

i. Show that the six cupboards may not fit along the wall.

[3]

ii. Find the upper bound of the space remaining if six cupboards do fit along the wall.

(ii) ..... cm **[3]**

32. Force is measured in newtons (N).
A force of 198.5 N is applied to a rectangular surface of length 4.9 cm and width 4.1 cm.

Work out an **estimate** of the pressure, in N / cm^2, applied to this rectangular surface.

[The formula for pressure is: $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$]

..... N / cm^2 **[4]**

33. The formula

$P = 6800 \times 1.045^n$

is used to predict the population, P, of an island n years after 2018.

i. Work out the population predicted by the formula for the year 2030.

(i) .....**[2]**

ii. Give **one** reason why the answer to **(i)** may **not** be reliable.

[1]

34. Calculate $\sqrt{\frac{8.4^2 - 1.9^2}{2.5 + 5.7}}$

Write your answer correct to **3** significant figures.

.....**[3]**

END OF QUESTION PAPER