Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C300UB0-1

A20-C300UB0-1

Part of WJEC

THURSDAY, 5 NOVEMBER 2020 – MORNING

MATHEMATICS – Component 2
Calculator-Allowed Mathematics
HIGHER TIER

2 hours 15 minutes

For Examiner's Use Only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**4**	
3.	**3**	
4.	**3**	
5.	**3**	
6.	**5**	
7.	**5**	
8.	**6**	
9.	**4**	
10.	**4**	
11.	**4**	
12.	**3**	
13.	**3**	
14.	**2**	
15.	**5**	
16.	**7**	
17.	**7**	
18.	**6**	
19.	**3**	
20.	**8**	
21.	**3**	
22.	**4**	
23.	**6**	
24.	**4**	
25.	**7**	
26.	**6**	
Total	**120**	

ADDITIONAL MATERIALS

A calculator will be required for this examination.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Do not use gel pen or correction fluid.
You may use a pencil for graphs and diagrams only.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** the questions in the spaces provided.
If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.
Take π as 3·142 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.
Unless stated, diagrams are not drawn to scale.
Scale drawing solutions will not be acceptable where you are asked to calculate.
The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the need for good English and orderly, clear presentation in your answers.

NOV20C300UB0101

C300UB01 01

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

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

$$v^2 = u^2 + 2as$$

Examiner only

1. *(a)* Emma buys a car for £6500.
She later sells it for £5720.

Calculate her percentage loss. [2]

(b) Emma buys another car for £8495.
Its value decreases by 16% each year.

What is the car's value after 11 years? [3]

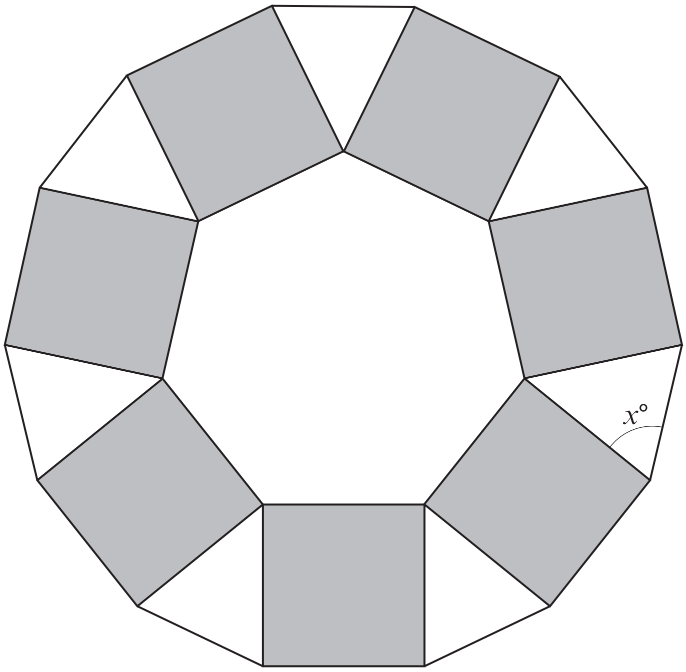
C300UB01
03

(C300UB0-1)

Turn over.

Examiner only

2.



This pattern is made from a regular seven-sided polygon surrounded by squares and isosceles triangles.

Show that the value of x is 64·3 correct to 1 decimal place. [4]

You must show all your working.

Examiner only

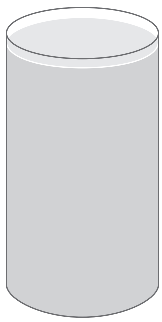
3. Rashid plays a game.
Each time he can score 1 point, 5 points or 10 points.
The table shows the probability of each outcome.

Points	Probability
1	0·80
5	0·15
10	0·05

Rashid plays the game 40 times.

How many times does he expect to score more than 1 point? [3]

4. A cylindrical glass contains 500 cm^3 of water.
The glass has an internal radius of 3·5 cm.

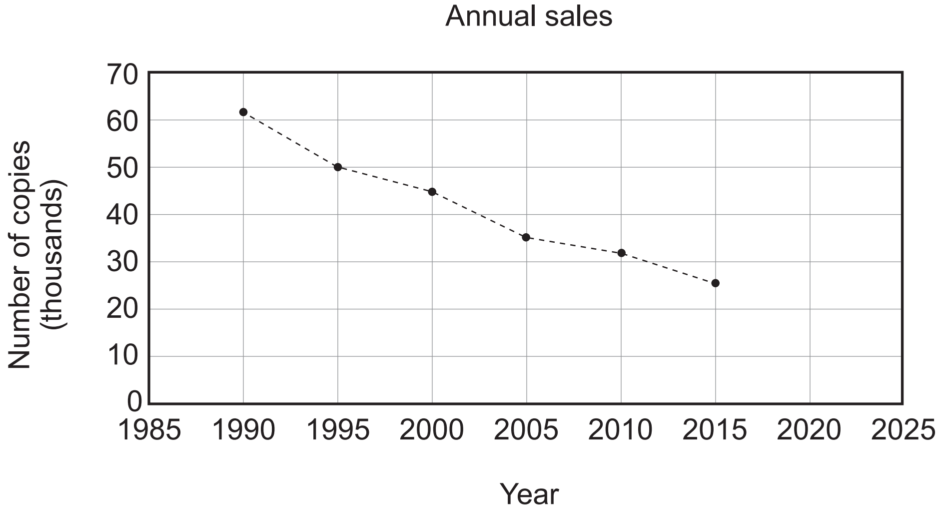


Calculate the height of the water in the glass. [3]

C300UB01 05

Examiner only

5. The graph shows the number of copies of a local newspaper sold over a 25-year period.



(a) Eva uses the graph to predict that about 10 thousand newspapers will be sold in 2025.

Explain why her prediction may not be reliable. [1]

....

....

(b) The ratio of adults who read news online to those who do not is 16 : 9.
The adult population of the UK is about 52 000 000.

Calculate an estimate of the number of adults in the UK who read news online. [2]

....

....

....

....

Examiner only

6. *ABCD* is a parallelogram.

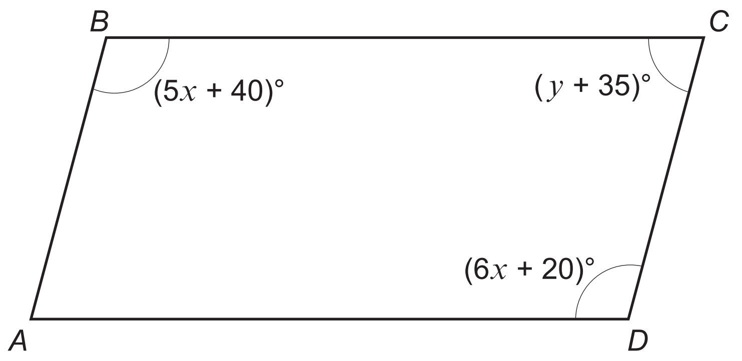


Diagram not drawn to scale

Work out the value of x and the value of y.
You must show all your working. [5]

x = ... y = ...

C300UB01 07

 (C300UB0-1)

Turn over.

Examiner only

7. Cheng stands at O and rolls a ball along the horizontal ground.

The ball stops at point B, which:

- is equidistant from X and Y,
- lies on the bisector of angle XOY.

Use a ruler and a pair of compasses to **construct** suitable lines and arcs to show the position of point B.

Construction arcs must be clearly shown. [5]

 (C300UB0-1)

Examiner only

8. The diagram shows two right-angled triangles.

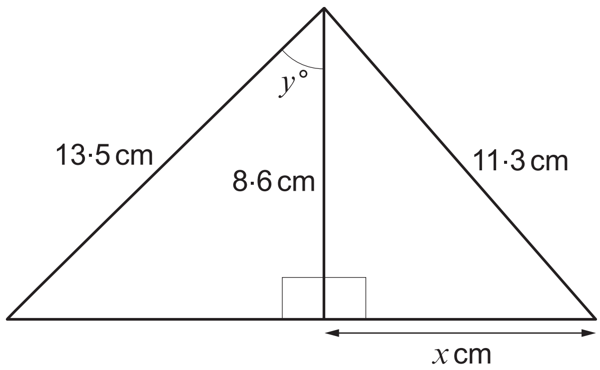


Diagram not drawn to scale

(a) Calculate the value of x. [3]

....

....

....

....

....

....

....

....

(b) Calculate the value of y. [3]

....

....

....

....

....

....

....

....

Examiner only

9. The speed limit on a road is decreased from 70 mph to 50 mph.
The road is 7·3 miles long.

How much longer does it take to travel along the road at 50 mph than at 70 mph?
Give your answer in minutes correct to 1 decimal place. [4]

Examiner only

10. *(a)* 7476 football supporters watched the first match of the season.

The ratio of men : women : children was 10 : 8 : 3.

Show that 712 more men than women watched the match. [2]

(b) At the second match of the season, the ratio of adults : children was 5 : 3.

At the third match, $\frac{2}{3}$ of the supporters were adults.

At which of these two matches was the proportion of adults higher?

You must show your working. [2]

Second match ☐ Third match ☐

C300UB01
11

Examiner only

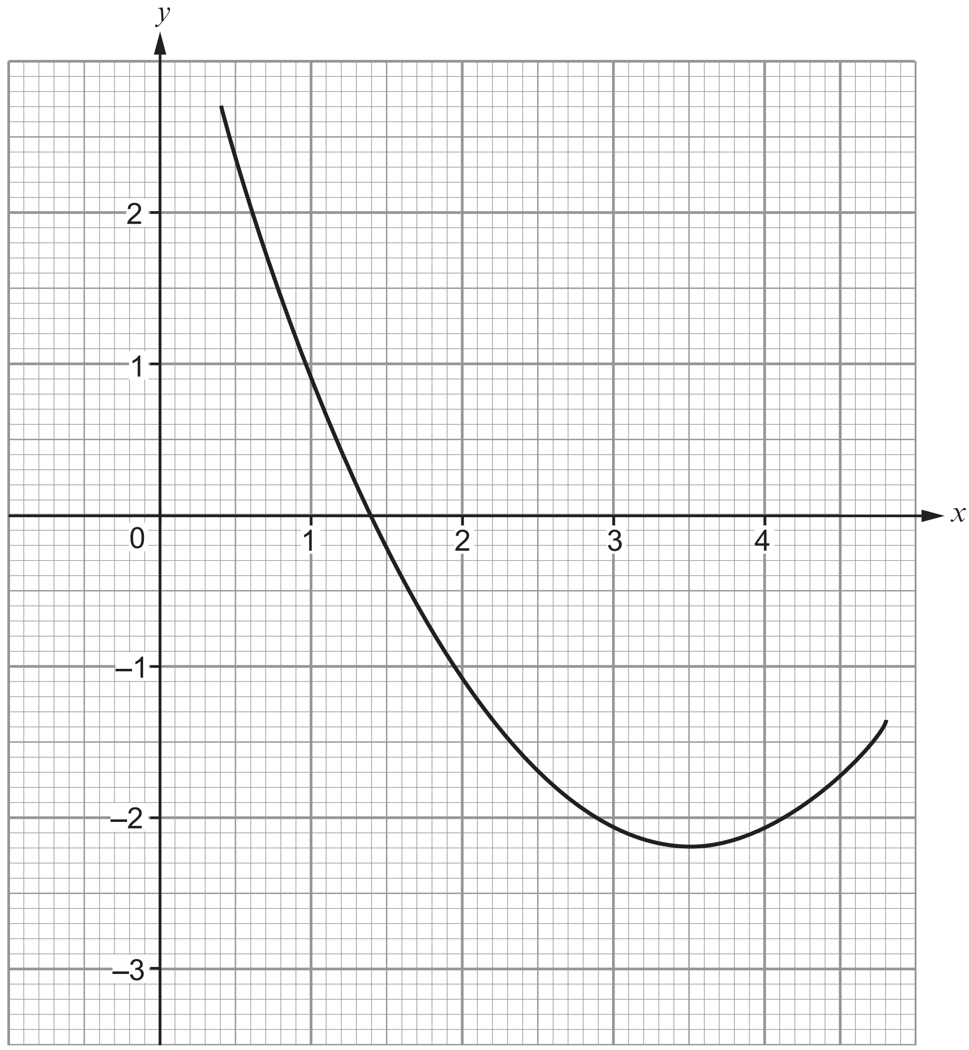
11. A full bottle containing 1 litre of cooking oil has mass 1270 g.
400 ml of cooking oil is used.

The bottle with the remaining cooking oil has mass 900 g.

Calculate the mass of the empty bottle. [4]

Examiner only

12. The graph shows part of a quadratic curve.



(a) Use the graph to write down the minimum value of y. [1]

....

(b) The curve cuts the x-axis at (1·4, 0) and (a, 0).

Calculate the value of a. [2]

....

....

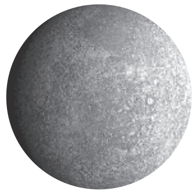
....

....

C300UB01
13

Examiner only

13. The mass of the planet Mercury is $3{\cdot}30 \times 10^{23}$ kg.
The volume of the planet Mercury is $6{\cdot}08 \times 10^{19}\,\text{m}^3$.



Calculate the density of the planet Mercury in kg/m^3.
Give your answer to 3 significant figures. [3]

Density = ... kg/m^3

14. n is a positive integer.

Prove that, for all possible values of n, $(2n-1)^2$ is an odd number. [2]

Examiner only

15. The mean of the data in the frequency table below is 2·7.

x	Frequency
1	a
2	5
3	1
4	b
5	2
6	3
Total	30

Work out the values of a and b.
You must show all your working. [5]

C300UB01 15

Turn over.

Examiner only

16.

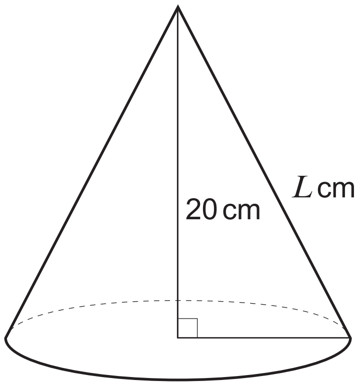


Diagram not drawn to scale

(a) A cone has vertical height 20 cm.
The volume of the cone is 2400 cm^3.

Calculate L, the slant height of the cone. [4]

Examiner only

(b) Cones *A* and *B* are mathematically similar.

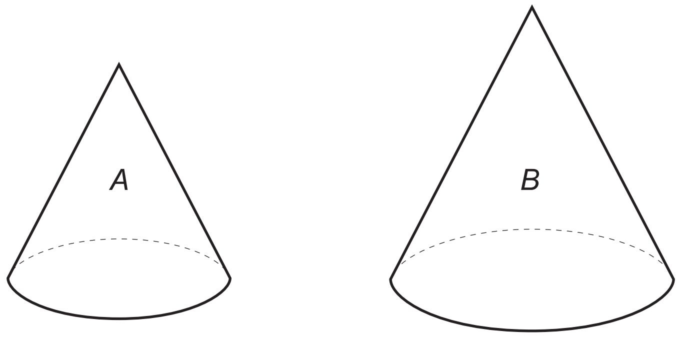


Diagram not drawn to scale

The diameter of the base of cone *A* is 12 cm.
The diameter of the base of cone *B* is 18 cm.

The total surface area of cone *A* is 300 cm^2.

Calculate the total surface area of cone *B*. [3]

....

....

....

....

....

....

....

....

Examiner only

17. A rectangle has:

- length y cm,
- perimeter 30 cm,
- area 55 cm^2.

(a) Form an equation in y and show that it can be simplified to $y^2 - 15y + 55 = 0$. [3]

(b) (i) Use the quadratic formula to solve the equation given in part *(a)*.
Give your answers correct to 2 decimal places.
You must show all your working. [3]

(ii) Interpret your answers in terms of the rectangle. [1]

Examiner only

18. A pet hotel is allowed to have a maximum of 10 pets at one time.
It takes only cats and dogs.
Each cat requires 1 unit of accommodation and each dog requires 3 units of accommodation.
For the hotel to make a profit, there must be at least 15 units occupied each day.

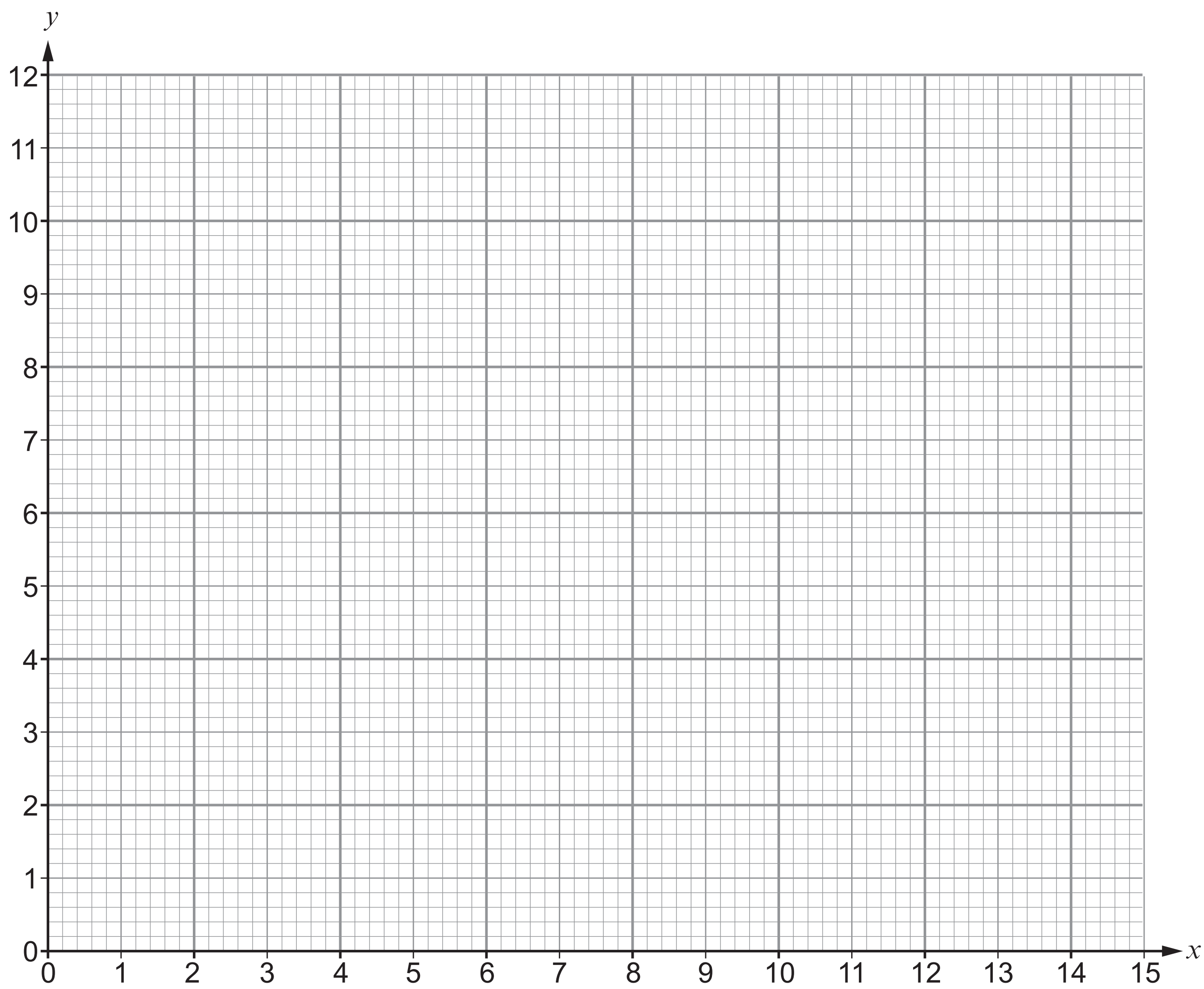
Let x be the number of cats and y the number of dogs in the pet hotel.

(a) Two inequalities that represent this information are $x \geqslant 0$ and $y \geqslant 0$.
Write down **two** *further* inequalities that represent the information. [2]

....

....

(b) On the graph paper below, draw the region that satisfies all of these inequalities.
Indicate clearly the region that is your answer. [3]



(c) One Wednesday there are enough pets staying for the hotel to make a profit.
What is the fewest number of **dogs** that could be in the hotel? [1]

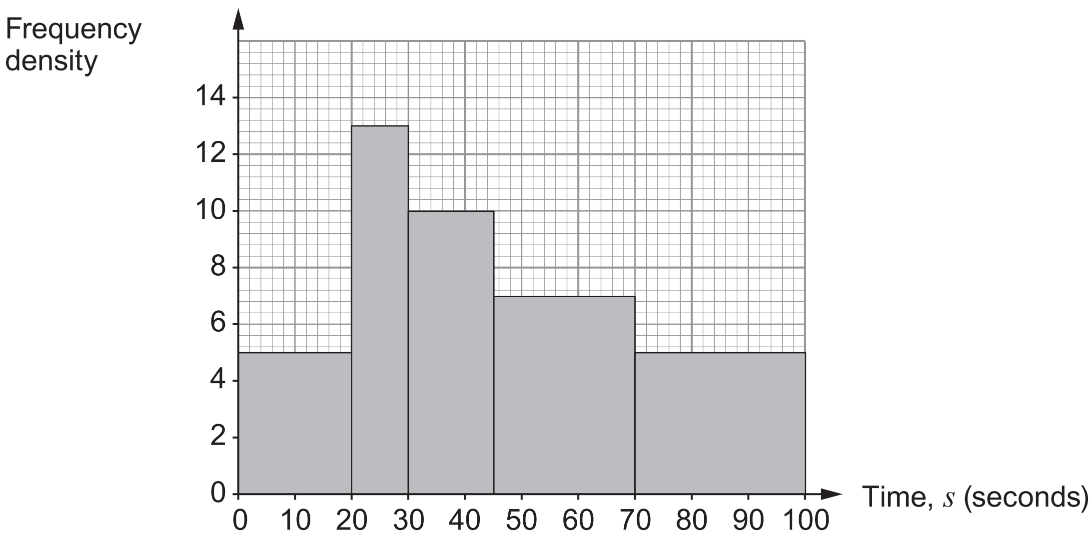
....

Examiner only

19. *(a)* Freya records how long each of 40 people can hold their breath.
The results are shown in the table.

Time, s (seconds)	Frequency
$0 < s \leqslant 20$	5
$20 < s \leqslant 30$	13
$30 < s \leqslant 45$	10
$45 < s \leqslant 70$	7
$70 < s \leqslant 100$	5

Freya wants to draw a histogram for this data.
This is the graph she draws.



Has Freya drawn a histogram?

Yes ☐ No ☐

Give a reason for your answer. [1]

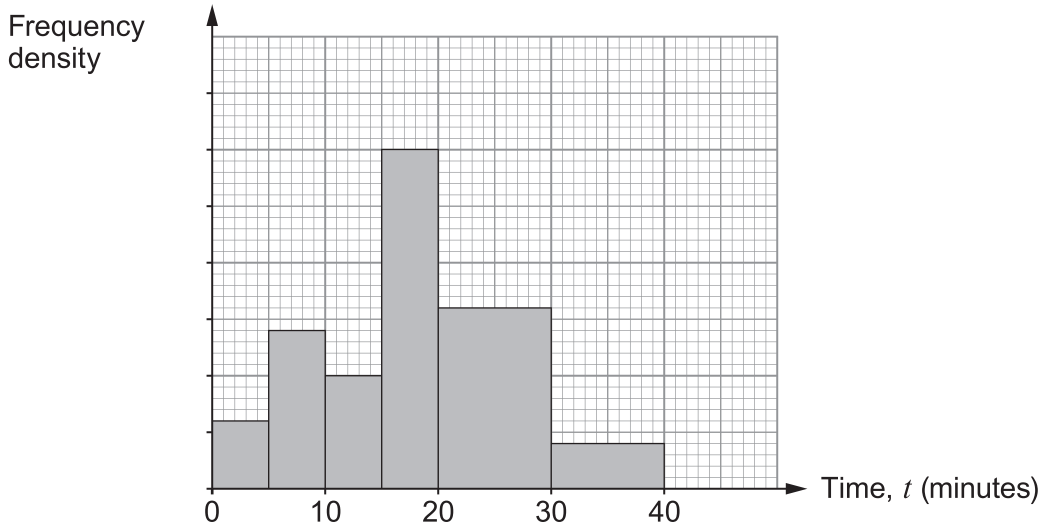
....

....

 (C300UB0-1)

Examiner only

(b) In one month, 2000 patients visited a doctors' surgery.
This histogram shows information about the length of time, t minutes, these 2000 patients spent at the surgery.



The group $0 < t \leqslant 5$ represents 120 patients.

How many patients are represented by the group $30 < t \leqslant 40$? [2]

Examiner only

20. *(a)* On any working day, the probability that Don oversleeps in the morning is 0·3.

When he oversleeps, the probability that he catches his train to work is 0·25.
When Don does not oversleep, he always catches his train.

Work out the probability that, on a randomly chosen working day, Don catches his train to work. [3]

Examiner only

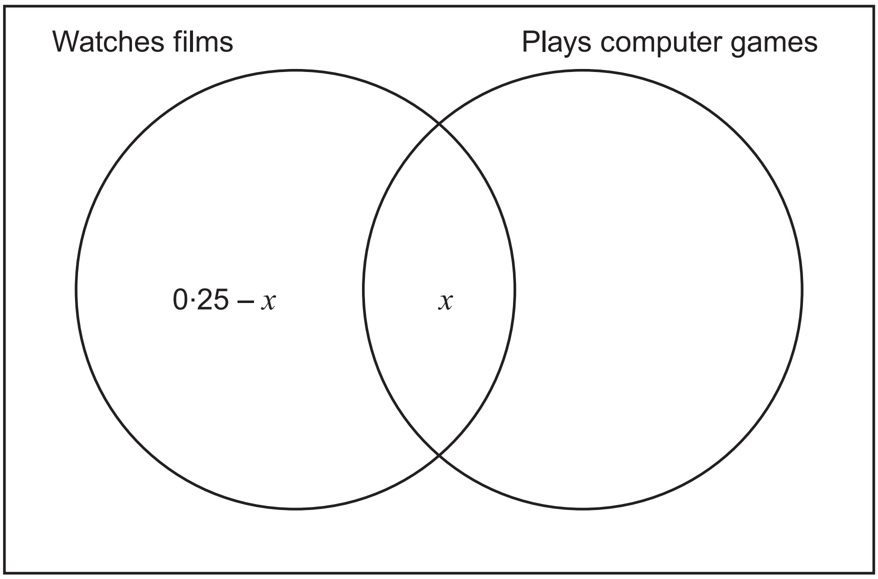
(b) Don sometimes spends his evenings watching films, playing computer games, or doing both.

On any evening the probability that Don:

- watches films is 0·25,
- plays computer games is 0·45,
- does neither is three times the probability that he does both.

(i) Complete the Venn diagram. [1]

ε



(ii) Work out the probability that, on any randomly chosen evening, Don watches films **and** plays computer games. [2]

....

....

....

....

(iii) On the evenings Don watches films, what is the probability that he also plays computer games? [2]

....

....

....

....

Examiner only

21. When a ball is thrown upwards on the Moon, the maximum height, h metres, it reaches is given by the formula $h = \dfrac{U^2}{2a}$.

In a particular case, U = 4·2 and a = 1·6, both correct to 2 significant figures.

Calculate the greatest possible value of h. [3]

Examiner only

22. *(a)* Show that $x = \sqrt{x + 7}$ is a rearrangement of $x^2 - x - 7 = 0$. [1]

(b) Use the iteration formula

$$x_{n+1} = \sqrt{x_n + 7} \text{ starting with } x_1 = 3$$

to find a solution of $x^2 - x - 7 = 0$. Give your answer correct to 2 decimal places.

You must give all your calculated values of x_{n+1}. [3]

Examiner only

23.

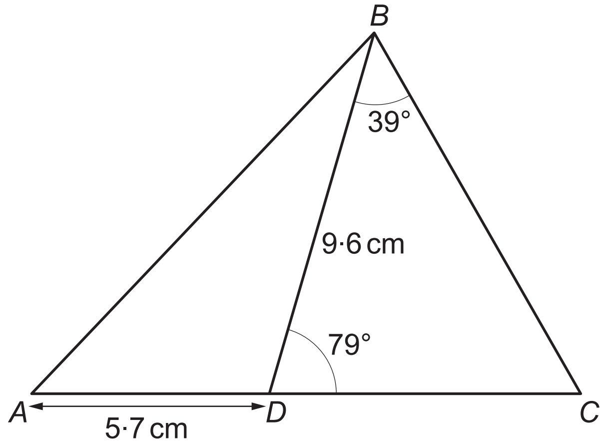


Diagram not drawn to scale

In the diagram, $AD = 5{\cdot}7$ cm, $BD = 9{\cdot}6$ cm, $B\hat{D}C = 79°$ and $D\hat{B}C = 39°$.

ADC is a straight line.

(a) Calculate the length of *DC*. [3]

....

....

....

....

....

(b) Mona assumes that the values in the diagram are all exact and uses these to work out the area of triangle *ABD*.
In fact, the lengths are correct but $B\hat{D}C$ has been **rounded up** to the nearest whole number.

Is Mona's answer too large or too small?
Use calculations to justify your decision. [3]

Too large ☐ Too small ☐

....

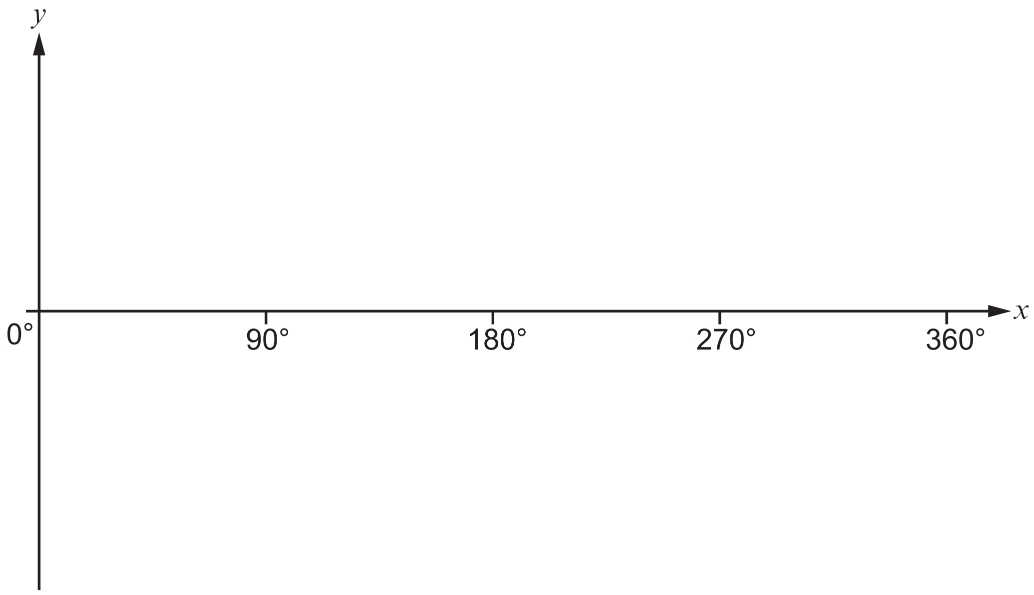
....

....

....

Examiner only

24. *(a)* On the axes below, sketch the graph of $y = \tan x°$ where $0° \leqslant x \leqslant 360°$. [2]



....

....

(b) Solve the equation $\tan x = 0{\cdot}8391$ in the range $0° \leqslant x \leqslant 360°$. [2]

....

....

....

....

Examiner only

25. *(a)* The number of voles, V, on an island t years after the first voles are introduced is given by the formula

$$V = 135 \times 1{\cdot}06^t.$$

(i) How many voles were initially introduced? [1]

(ii) What is the percentage increase in the number of voles 5 years after they were introduced? [2]

(iii) When the number of voles reaches 500, the population starts decreasing at a rate of 5% **per month**.

The formula $V = 500 \times k^T$ is now used to model the number of voles, V, where T is the number of **years** after the population reached 500.

What value of k should be used? [1]

(b) A population of birds on the island has a constant growth rate, p%, per year.
There were initially 300 birds.
The population doubles in 20 years.

Calculate the value of p. [3]

Examiner only

26. The diagram shows a sector of a circle with radius r cm and angle $x°$.

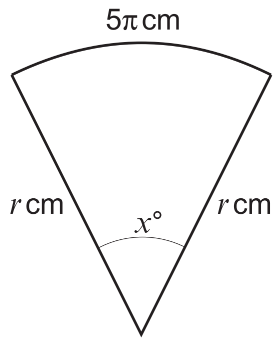


Diagram not drawn to scale

The arc length of the sector is 5π cm.

(a) Show that $x = \dfrac{900}{r}$. [2]

....

....

....

....

....

(b) The area of the sector is 30π cm^2.

Calculate the value of x. [4]

....

....

....

....

....

....

....

END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

Examiner only

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

Examiner only

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE