

For **OCR**

**H**

**GCSE (9–1) Mathematics**

**Paper 4 (Higher Tier)**

**Churchill Paper 4A**

Time allowed: 1 hour 30 minutes

**You may use:**

- A scientific or graphical calculator
- Geometrical instruments
- Tracing paper

**Name**

**Class**

**INSTRUCTIONS**

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Write your name and class in the boxes above.
- Answer **all** the questions.
- Read each question carefully before you start your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.

**INFORMATION**

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [ ].
- Use the  $\pi$  button on your calculator or take  $\pi$  to be 3.142 unless the question says otherwise.



Written by Shaun Armstrong

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However, this paper is available as a sample that can be used without licence.

Answer **all** the questions

- 1 George, Verity and Siobhan are going to cook scrambled eggs.  
The recipe they are using requires these ingredients to make two portions:

4 eggs  
250 ml milk  
30 g butter

- (a) How many eggs does George need to make three portions of scrambled eggs?

(a) ..... [1]

- (b) Verity is going to use 75 g of butter.

How much milk will she need to use?

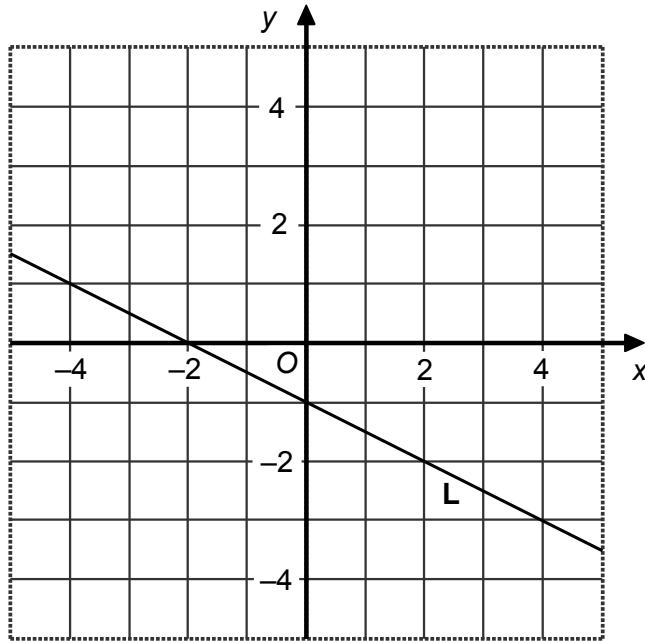
(b) ..... ml [2]

- (c) Siobhan has 20 eggs, 2 litres of milk and 500 g of butter.

Work out the maximum number of portions of scrambled eggs she can make.

(c) ..... portions [3]

2



Find the equation of the straight line **L** in the form  $y = mx + c$ .

..... [3]

3 Before going to France, Wasim changed £500 into Euros.  
He got an exchange rate of £1 = €1.38

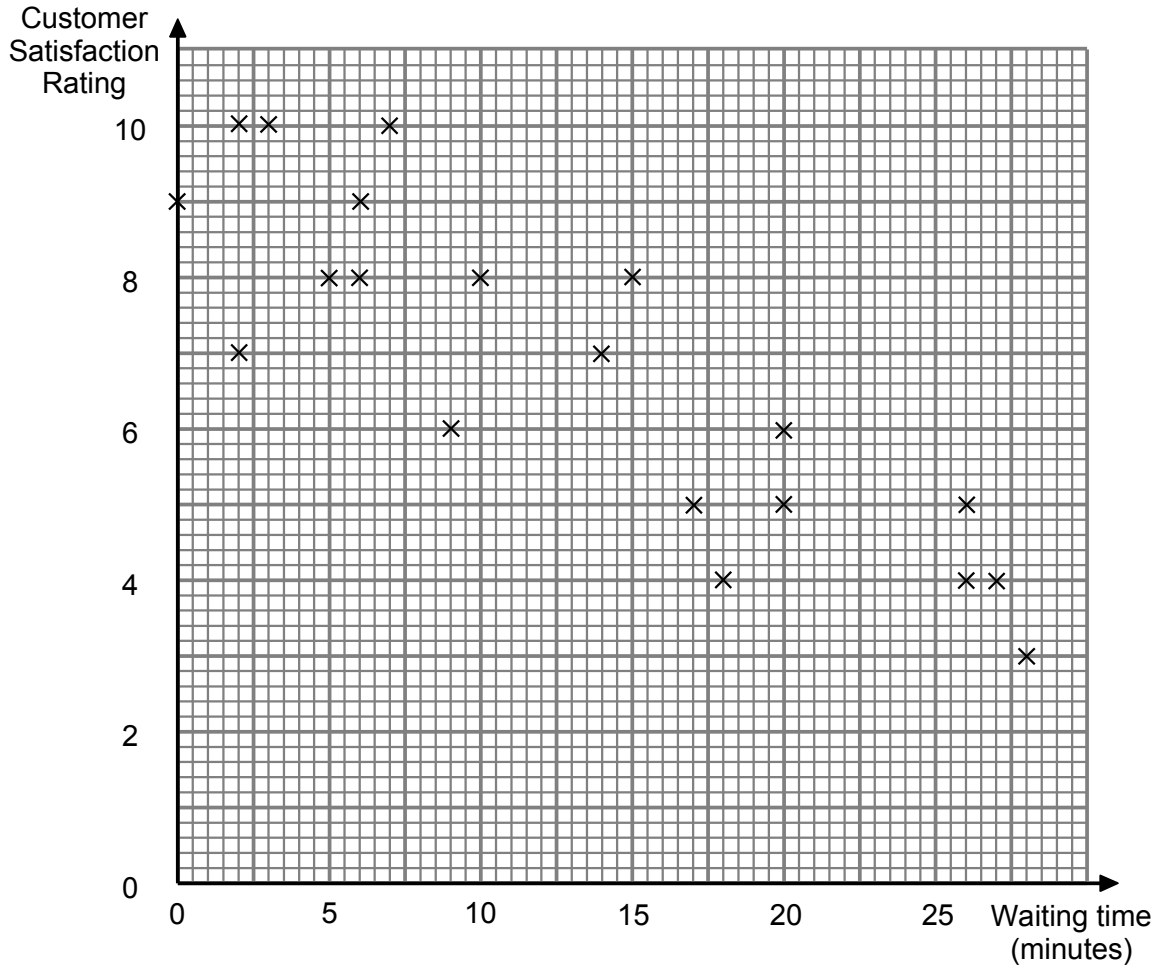
Whilst in France Wasim spent €465.

When he returned, he changed his remaining Euros into pounds.  
This time he got an exchange rate of £1 = €1.31

Work out how much he got back in pounds.

£ ..... [3]

- 4 A company has a customer support telephone line. The company records how long each customer waits for their call to be answered. At the end of each call, the customer is asked to rate their satisfaction on a scale of 1 to 10. The scatter graph shows this information for 20 calls to its support line, selected at random.



- (a) Calculate the percentage of these callers who gave a rating of 8 or more.

(a) ..... % [2]

- (b) Another caller waited 23 minutes for their call to be answered.

Use a line of best fit to estimate the satisfaction rating this customer gave.

(b) ..... [2]

- (c) Explain why the line of best fit used in part (b) could not be used to estimate the satisfaction rating for a customer who waited 50 minutes for their call to be answered.

.....  
 ..... [1]

- 5 31 pupils were given a short times tables test.  
 The table shows information about how long it took them to complete the test.

Time taken (seconds)	Number of pupils
$20 < N \leq 25$	6
$25 < N \leq 30$	10
$30 < N \leq 35$	3
$35 < N \leq 40$	4
$40 < N \leq 50$	3
$50 < N \leq 70$	5

- (a) In which class interval is the median time taken?

(a) ..... [2]

- (b) Joe says

There are 19 pupils in the classes up to 35 and only 12 in those above 35,  
 so the mean must be less than 35.

Joe is not correct. Explain why.

.....  
 .....  
 ..... [1]

**6** Eileen, Layla and Naira have all just been paid.

Layla received £60 more than Eileen.  
Naira received 50% more than Eileen.  
Altogether they received £900.

How much did Naira receive?

£ ..... [4]

**7** The diameter of the planet Neptune is 49 244 km.

The mean distance of Neptune from the Sun is 30.069 AU.

AU stands for “astronomical unit” and is the mean distance of the Earth from the Sun.

1 AU = 149 597 871 km.

How many times greater is Neptune's mean distance from the Sun than Neptune's radius?

Give your answer in standard form to an appropriate degree of accuracy.

..... [4]

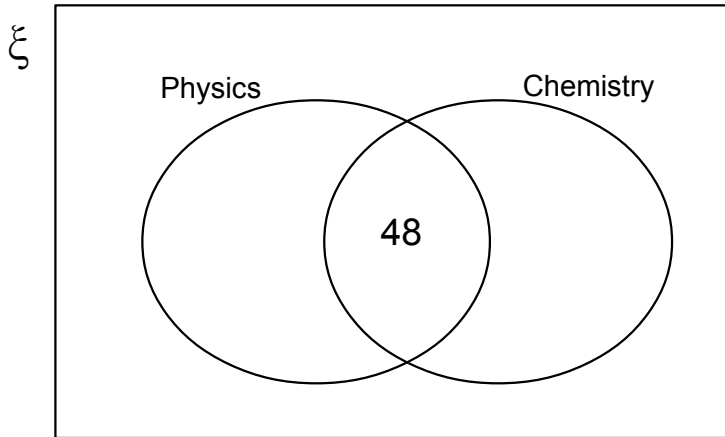
8 200 students at a school are studying for A levels.

78 of the students study Physics.

60 of the students study Chemistry.

48 of the students study both Physics and Chemistry.

(a) Complete this Venn diagram representing this information.



[2]

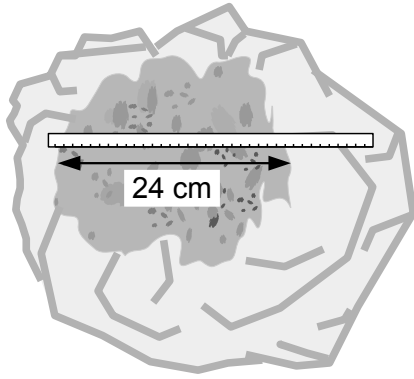
(b) One of these 200 students is chosen at random.

(i) Work out the probability that they don't study Physics or Chemistry.

(b)(i) ..... [1]

(ii) Given that the student chosen studies Chemistry, work out the probability that they don't study Physics.

(ii) ..... [2]



Not to scale

The sketch shows a growth of lichen on a rock.

A scientist wants to find the area covered by the lichen. She measures the distance across the area of lichen and records it as 24 cm. She then estimates the area using this calculation:

$$\text{Area} \approx 3 \times 12^2 = 3 \times 144 = 432 \text{ cm}^2$$

- (a) The scientist has approximated the value of  $\pi$  by rounding it to 3.

Explain what effect this has had on her estimate.

.....  
 ..... [1]

- (b) Write down an assumption the scientist has made about the shape of the lichen.

Explain how this may have affected her estimate.

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



10 (a) Here is the start of a sequence.

4    11    18    25    ...

Find an expression for the  $n$ th term of this sequence.

(a) ..... [2]

(b) A mother gives her son 1p on the 1<sup>st</sup> January, 2p on the 2<sup>nd</sup> January, 4p on the 3<sup>rd</sup> of January and so on. The amount she gives him each day is twice the amount she gave him the previous day.

Show that the amount she gives him on the last day of January is  $2^k$  pence more than on the previous day, where  $k$  is an integer to be found.

[4]

11 (a) Given that  $a$  is an even number, prove that  $a^2$  is an even number.

[2]

(b) Eleanor says that if  $p$  and  $q$  are whole numbers then  $(pq + 1)^2$  will always be odd.

(i) Find values of  $p$  and  $q$  to show that Eleanor is wrong.

Justify your answer.

[2]

(ii) If  $(pq + 1)^2$  is even, what can you say about the numbers  $p$  and  $q$ ?

You must justify your answer.

.....

.....

.....

..... [2]

12 (a)  $P$  is directly proportional to  $Q$ .

When  $Q = 6$ ,  $P = 15$ .

Work out the value of  $P$  when  $Q = 3.5$

(a) ..... [3]

(b) Two variables,  $x$  and  $y$  are related.

When  $x = 2$ ,  $y = 20$

When  $x = 4$ ,  $y = 5$

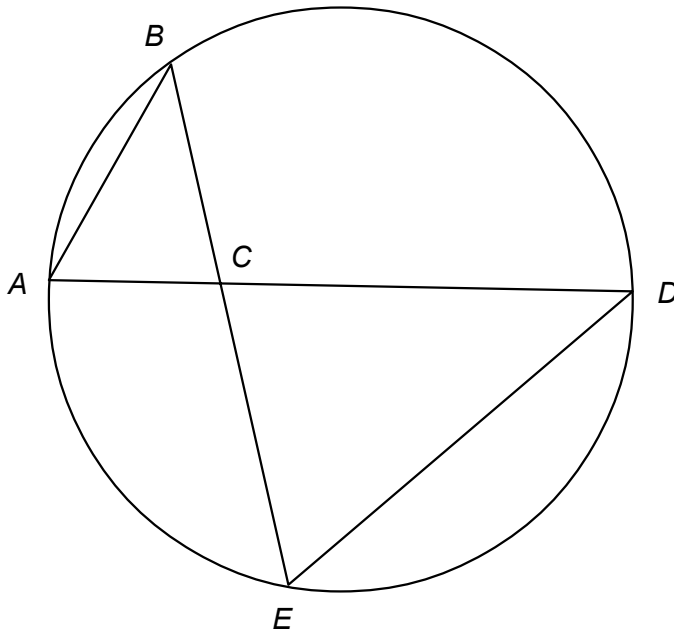
Cyrus says that  $y$  is inversely proportional to  $x$ .

Dinah says that  $y$  is inversely proportional to  $x^2$ .

Find out if either Cyrus or Dinah could be correct.  
Justify your answer.

[3]

13



Not to scale

Points  $A$ ,  $B$ ,  $D$  and  $E$  lie on the circumference of a circle.  
The straight lines  $AD$  and  $BE$  intersect at the point  $C$ .

(a) Prove that triangle  $ABC$  and triangle  $CDE$  are similar.

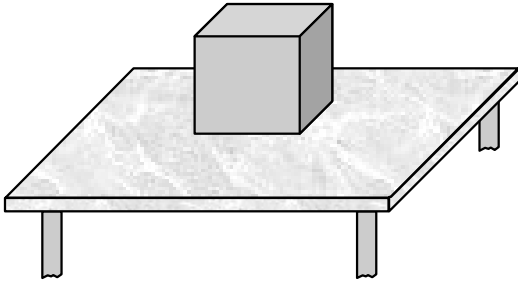
[3]

$AB = 5.2$  cm,  $DE = 7.8$  cm and  $BC = 4.6$  cm.

(b) Work out the length of  $CD$ .

(b) ..... cm [2]

14



Not to scale

A solid wooden cube is placed on a table.  
The cube exerts a force of 7 newtons on the table.  
The pressure on the table is 700 newtons/m<sup>2</sup>.

Given that the density of the wood is 720 kg/m<sup>3</sup>, find the mass of the cube.

[ Pressure =  $\frac{\text{force}}{\text{area}}$  ]

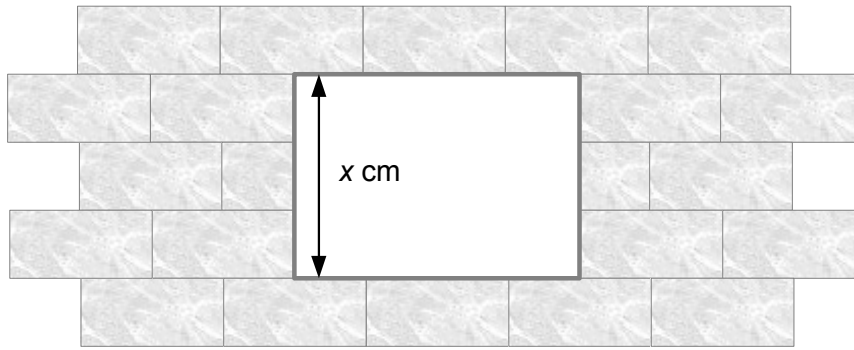
..... kg [5]

15 Without using a calculator, show clearly that

$$4^{-2} \times 8^3 = 32$$

[3]

16



Not to scale

A rectangular vent in a wall is to be  $x$  cm high.  
The width of the vent is to be 4 cm more than the height.  
The area of the cross-section of the vent must be at least  $140 \text{ cm}^2$ .

By forming and solving a suitable inequality, find the smallest possible value of  $x$ .

..... [5]

17 The value of a rare stamp £ $V$  is modelled by the equation

$$V = 2500 \times 1.3^t$$

where  $t$  is the number of years after 1<sup>st</sup> January 2015.

Using this model,

(a) work out the value of the stamp on 1<sup>st</sup> January 2016,

(a) £ ..... [2]

(b) state the percentage increase in the value of the stamp each year.

(b) ..... % [1]

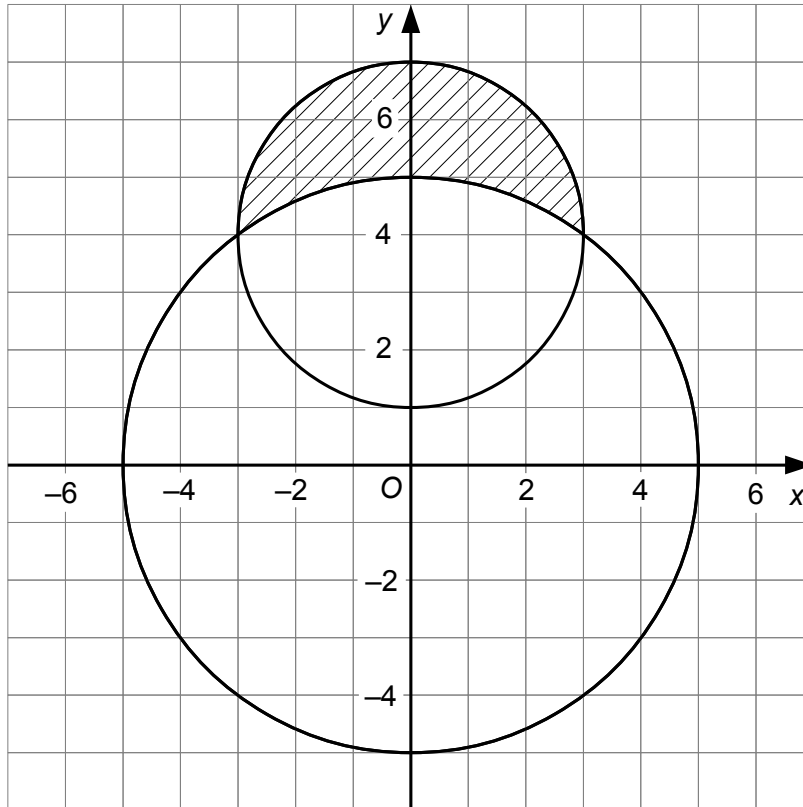
The actual value of the stamp on 1<sup>st</sup> January 2017 was £3660.

Using this information, the model is to be revised but will still be of the form

$$V = 2500 \times k^t$$

(c) Find, to 3 significant figures, the value of the constant  $k$ .

(c)  $k =$  ..... [3]



Not to scale

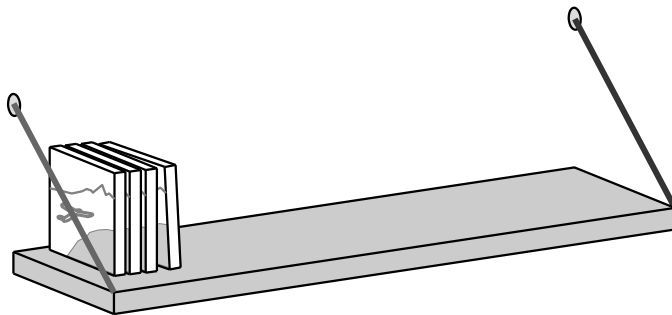
The diagram shows two circles on a centimetre square grid.  
 One circle has radius 5 cm and centre  $(0, 0)$ .  
 The other circle has radius 3 cm and centre  $(0, 4)$ .  
 The two circles intersect at the points  $(3, 4)$  and  $(-3, 4)$ .

Find the area of the shaded shape.



..... cm<sup>2</sup> [7]

19



Not to scale

Kath is going to store her games on a shelf.

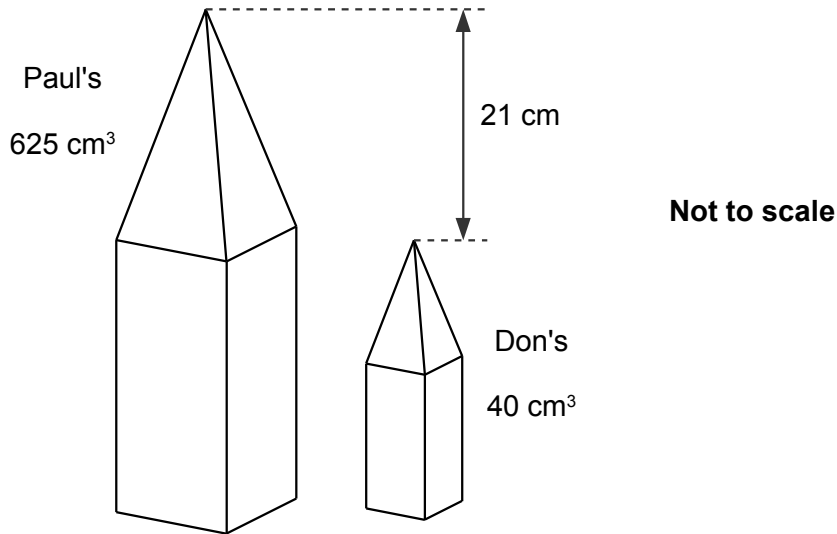
The width of the shelf is 1.2 m correct to 1 decimal place.

The thickness of each game case is 14 mm correct to the nearest mm.

Work out the maximum number of games she will be able to fit on the shelf as shown.

..... [3]

20



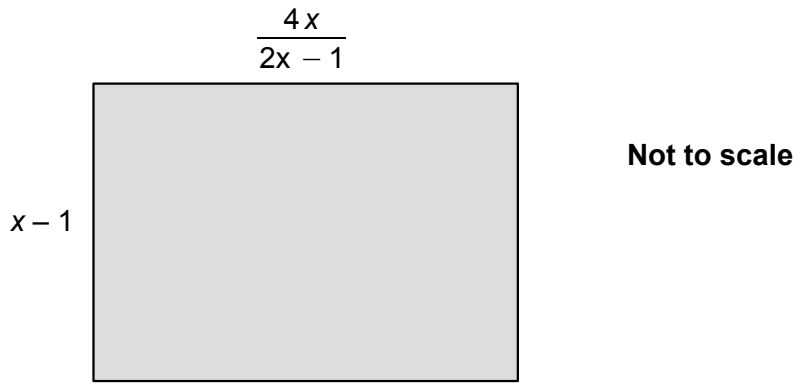
Paul and Don build scale models of a tower from clay.  
Their models are solid and mathematically similar.

Paul used 625 cm<sup>3</sup> of clay.  
Don used 40 cm<sup>3</sup> of clay.

Given that Paul's model is 21 cm taller than Don's, work out the total height of Paul's model.

..... cm **[5]**

21



A rectangle measures  $(x - 1)$  m by  $\frac{4x}{2x - 1}$  m.

The perimeter of the rectangle is 8 m.

Prove that the area of the rectangle is  $3.75 \text{ m}^2$ .

[7]