For **OCR**

H

GCSE (9–1) Mathematics

Paper 5 (Higher Tier)

Churchill Paper 5E

Time allowed: 1 hour 30 minutes

You may use:
- Geometrical instruments
- Tracing paper

Do not use:
- A calculator

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 **[ ]**.

Churchill Maths

Written by Shaun Armstrong

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Answer **all** the questions

1 At a party, each child had chocolate, strawberry or vanilla ice cream.

The ratio of the number who had chocolate to the number who had strawberry was 5 : 4

The ratio of the number who had strawberry to the number who had vanilla was 3 : 2

Find the ratio of the number who had chocolate to the number who had vanilla.

Give your answer in the form $p : q$, where p and q are integers.

.... **[3]**

2 **(a)** Work out $3 \times 1.2 + 1.6 \div 2$

(a) .... **[3]**

(b) Work out an estimate for the value of

$$\frac{\sqrt{26} + 1.98}{(5.9)^2 - 8.3}$$

(b) .... **[3]**

3   Glenys organises a buffet to raise money for charity.

She spends £140 on hiring a room for the event.
She spends £315 on food for the buffet.

Tickets for the buffet cost £12 each.
Glenys sells 62 tickets.

Work out the amount of money raised for charity **per person** that bought a ticket.

Give your answer correct to the nearest penny.

£ .... **[5]**

4   Jen spends $\frac{3}{8}$ of her income on rent.

$\frac{6}{11}$ of the money she has left after paying rent goes on food and other living expenses.

She saves the rest of her income.

Work out the fraction of her total income that Jen saves.

.... **[3]**

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5   Liam plans to get fit using a treadmill.

In the first week of the year, he will spend 1 hour on the treadmill.
Each week, he will increase the amount of time he spends on it by 10 minutes.
For example, in the second week of the year, he will spend 1 hour 10 minutes on the treadmill.

(a)   Work out how long Liam spends on the treadmill in the fifth week of the year.

(a) .... **[2]**

(b)   Work out in which week of the year Liam spends 3 hours on the treadmill.

(b) .... **[2]**

Liam's friend Naz says

It's impossible to keep increasing the time like that for a year – there aren't enough hours in a week!
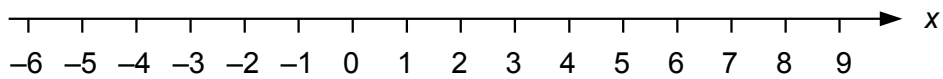
(c)   Is Naz correct?

Use calculations to show how you decide.

(c) .... **[3]**

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6 **(a)** Solve the inequality $\frac{1}{2}x + 9 > 3(x - 2)$

(a) .... **[2]**

(b) Represent your solution to part **(a)** on this number line.

$$\xleftarrow{\hspace{1cm}} \quad -6 \ -5 \ -4 \ -3 \ -2 \ -1 \ \ 0 \ \ 1 \ \ 2 \ \ 3 \ \ 4 \ \ 5 \ \ 6 \ \ 7 \ \ 8 \ \ 9 \xrightarrow{\hspace{1cm}} x$$

[1]

(c) Solve the inequality $x^2 \geq 16$

(c) .... **[2]**

7 Tim owns 140 books.
Each book is either fiction or non-fiction.
Also, each book has either a paperback or a hardback cover.

80 of Tim's books are fiction books with a paperback cover.
1 in 7 of his books are non-fiction books with a hardback cover.
The total number of fiction books is 10 more than the total number of books with a paperback cover.

(a) Complete the Venn diagram representing this information.

ξ = books that Tim owns

P = books with a paperback cover

F = fiction books
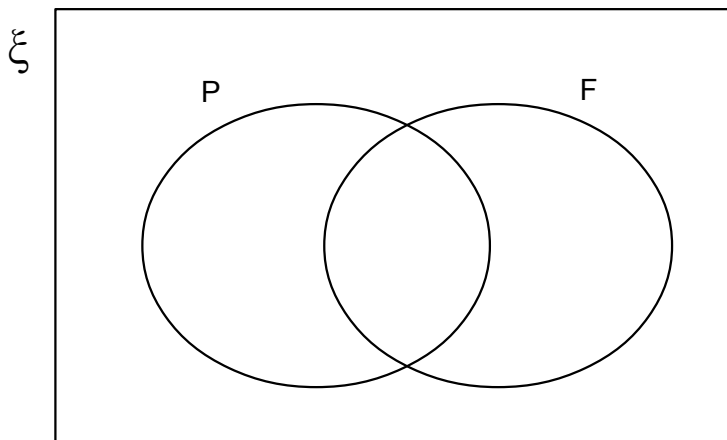
[3]

(b) Elisha picks one of Tim's books at random.

The one she picks has a hardback cover.

Find the probability that it is a non-fiction book.

(b) .... [2]

8 Function A is given by $y = \dfrac{x + 1}{2}$.

(a) Work out the output from Function A when the input is $x = 11$.

(a) .... **[1]**

Function B is given by $y = \dfrac{3}{x}$.

(b) Work out the output for the inverse of Function B when the input is $x = 9$.

(b) .... **[2]**

(c) Work out the output for the composite function "Function A followed by Function B" when the input is $x = \dfrac{1}{2}$.

(c) .... **[2]**

(d) The same positive number is used as the input for both Function A and Function B. The output from each function is the same.

Use algebra to work out the number that was used as the input.

(d) .... **[3]**

9 **(a)** There are three-quarters of a million bacteria in a dish.
The number of bacteria doubles every 40 minutes.

Work out how many bacteria there will be in the dish after 4 hours.

(a) .... **[3]**

(b) The value, £P, of a car after T years is given by the formula

$$P = 8000 \times 0.63^T$$

Work out the annual percentage decrease in the value of the car.

(b) .... % **[2]**

10 Express as a single number in standard form

(a) $(9.3 \times 10^7) + (8 \times 10^6)$

(a) .... **[2]**

(b) $\dfrac{4.2 \times 10^4}{1.4 \times 10^{-6}}$

(b) .... **[3]**

11

Not to scale
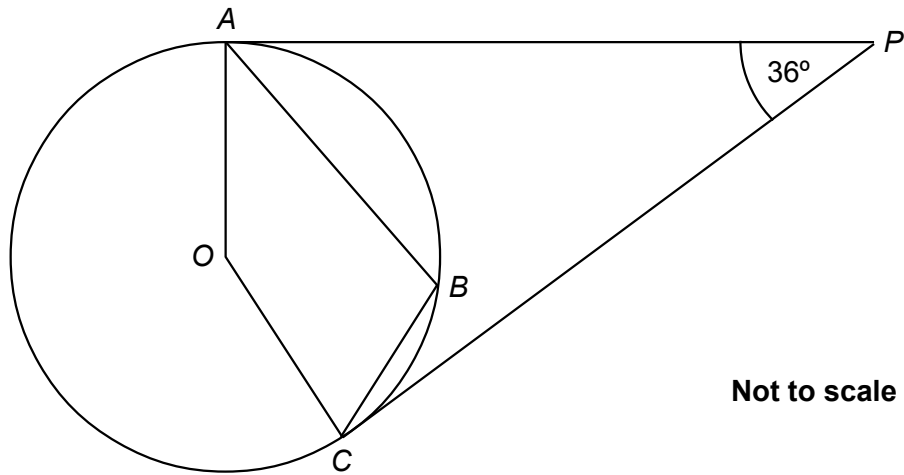
The points A, B and C lie on the circumference of a circle, centre O.

PA and PC are tangents to the circle.

Angle $APC = 36°$.

Prove that angle $ABC = 108°$.

[4]

12 At 9.00 am, Gethin leaves Swansea and drives to Aberystwyth.
The length of Gethin's route is 85 miles.

At 9.12 am, Bella also leaves Swansea and drives to Aberystwyth.
Bella's route is 10 miles shorter than Gethin's.

Gethin and Bella arrive in Aberystwyth at the same time.

Given that their average speeds on the journey were the same, work out the time at which they arrived.

.... **[4]**

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13
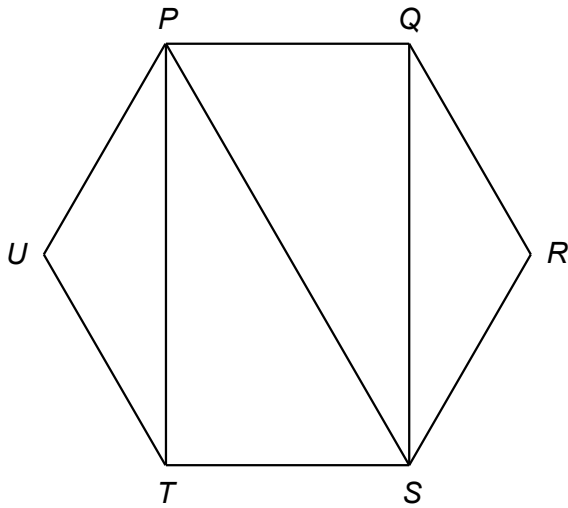
Not to scale

PQRSTU is a regular hexagon.

Prove that triangle PQS is congruent to triangle STP.

[3]

14 A company places an advert for its coffee machine in a magazine to try and increase sales. This table shows information about sales of the machine in the 30 days before the advert runs.
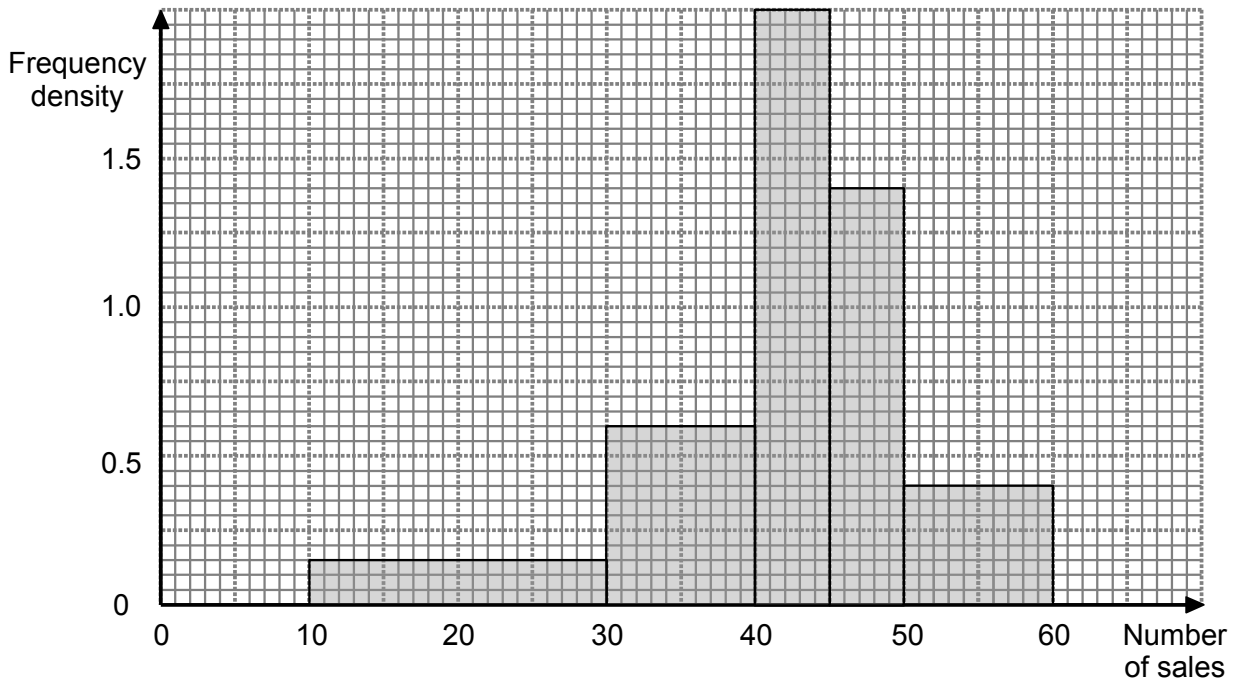
Number of sales (S)	Number of days
$10 \leq S < 30$	5
$30 \leq S < 40$	8
$40 \leq S < 45$	9
$45 \leq S < 50$	6
$50 \leq S < 60$	2

(a) On the grid, draw a histogram for the information in the table.
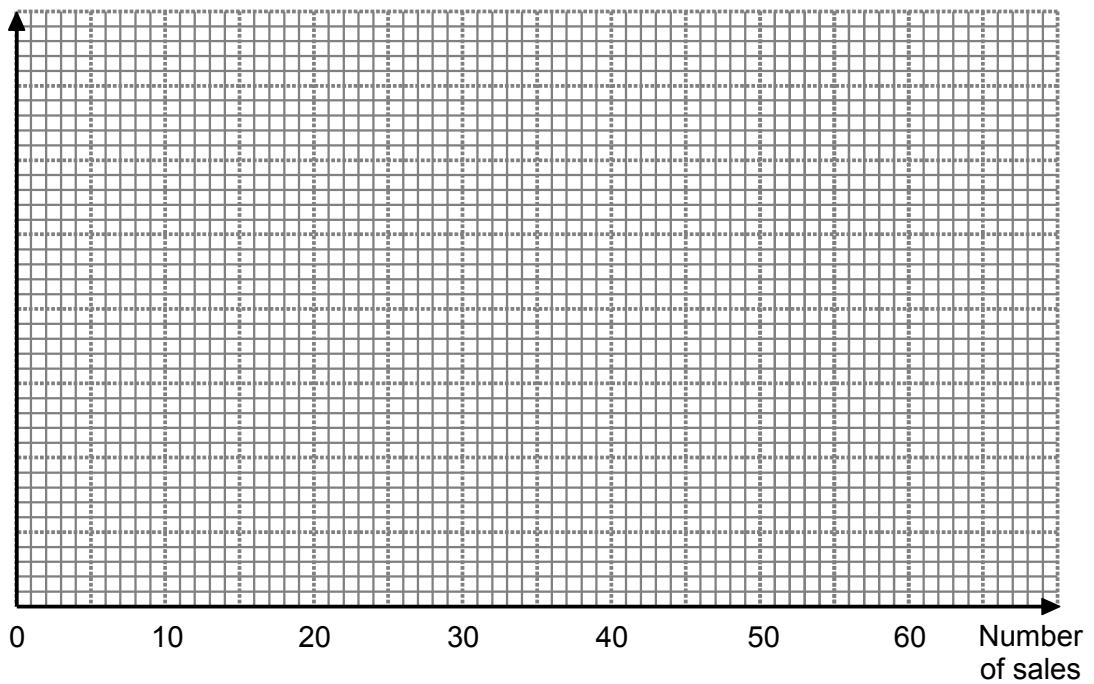
[4]

The histogram on the next page shows information about sales of the machine in the 30 days after the advert runs.

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(b) By comparing the two histograms, comment on whether or not the advert has been successful.

....

....

.... **[1]**

(c) For the 30 days after the advert, estimate the number of days on which the company sold 35 or more coffee machines.

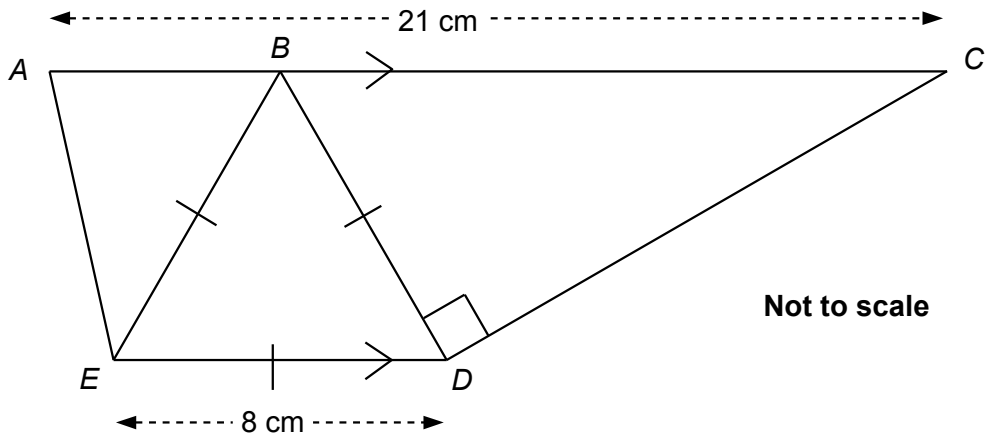(c) .... days **[2]**

(d) Explain why your answer to part **(c)** is only an estimate.

....

....

.... **[1]**

15

AC and ED are parallel lines.

B lies on AC and AC = 21 cm.

BD = BE = DE = 8 cm.

Angle BDC = 90º.

Show that the perimeter of trapezium ACDE can be written in the form $(a + b\sqrt{3})$ cm, where a and b are integers.

.... cm **[6]**

16 **(a)** Arrange these numbers in order of size, starting with the smallest.

$$\sqrt{65} \qquad \frac{1}{0.09} \qquad 7.9 \qquad (2.1)^3$$

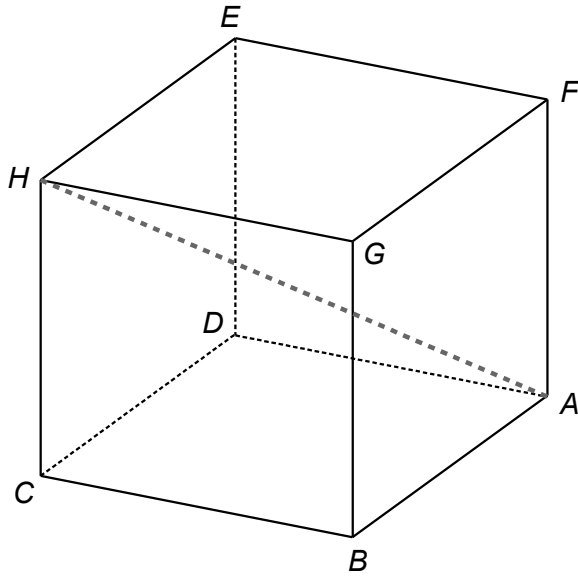(a) .... **[3]**

(b) Evaluate $27^{\frac{2}{3}}$

(b) .... **[2]**

(c) Find the value of x for which

$$25^x = 5^{\frac{7}{2}} \times 125^{-\frac{1}{3}}$$

(c) .... **[4]**

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Not to scale

The diagram shows a cube, *ABCDEFGH*.

The length of the diagonal, *AH*, is 12 cm.

Work out the surface area of the cube.

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

18   Given that for all values of x

$$(4x + a)(x - 2) \equiv (2x + 1)^2 + b$$

find the value of a and the value of b.

$a =$ ....

$b =$ .... **[5]**

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19

3x + 2y = 26

Not to scale
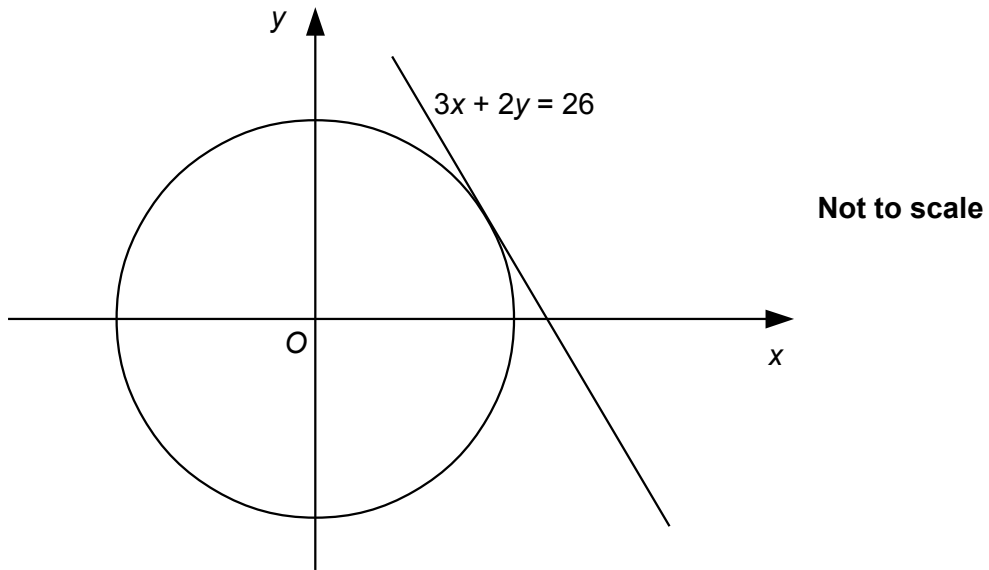
The line with equation 3x + 2y = 26 is a tangent to a circle with centre (0, 0).

Find the equation of the circle.

.... **[5]**