\

Name

Class

# For AQA

# GCSE Mathematics Specification

Paper 1 Higher Tier

Churchill Paper 1E

1 hour 30 minutes

### **Materials**

### For this paper you must have:

· mathematical instruments





## Instructions

- · Use black ink or black ball-point pen.
- Draw diagrams in pencil.
- Write your name and class in the box at the top of the page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- In all calculations, show clearly how you work out your answer.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.



Written by Shaun Armstrong

Only to be copied for use in a single school or college having purchased a licence

# Answer all questions in the spaces provided.

Work out  $3 \times 1.2 + 1.6 \div 2$ 1

Circle the answer.

[1 mark]

- 4.4
- 4.2
- 3.8
- 2.6

Work out  $\frac{3}{5} - \frac{2}{9}$ 2

Circle the answer.

[1 mark]

Circle the coordinates of the turning point of the curve with equation  $y = (x + 3)^2 + 1$ 3

[1 mark]

- (3, 1) (3, -1) (-3, 1) (-3, -1)

| 4 | Circle the number with the   | ne largest value               | ).                          |                    | [1 mark]  |  |  |
|---|--|--------------------------------|-----------------------------|--------------------|-----------|--|--|
|   | $\sqrt{65}$  | 1<br>0.09                      | 7.9                         | (2.1) <sup>3</sup> |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
| 5 | At a party, each child ha  | d chocolate, str               | awberry or va               | anilla 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 num  | ber who had ch                 | nocolate to the             | e number who had v | anilla.   |  |  |
|   | Give your answer in the  | form <i>p</i> : <i>q</i> , who | ere <i>p</i> and <i>q</i> a | re integers.       | [3 marks] |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |
|   |  | Answer                         |                             |                    |           |  |  |
|   |  | ,                              |                             |                    |           |  |  |
|   |  |                                |                             |                    |           |  |  |

| 6 | 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 <b>per person</b> that bought a ticket. |           |
|   | Give your answer correct to the nearest penny.  | [4 marks] |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   | Answer £  |           |
|   | Allswel £   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |
|   |   |           |

| 7 | Lian       | n plans to get fit using a treadmill.   |                 |  |  |  |  |  |
|---|------------|---|-----------------|--|--|--|--|--|
|   | Eac<br>For | the first week of the year, he will spend 1 hour on the treadmill. ach week, he will increase the amount of time he spends on it by 10 minutes. or example, in the second week of the year, he will spend 1 hour 10 minutes on the eadmill. |                 |  |  |  |  |  |
| 7 | (a)        | Work out how long Liam spends on the treadmill in the fifth week of the year  | r.<br>[2 marks] |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            | Answer  | _               |  |  |  |  |  |
| 7 | (b)        | Work out in which week of the year Liam spends 3 hours on the treadmill.  | [2 marks]       |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            | Answer  |                 |  |  |  |  |  |
|   | Lian       | n'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!"   |                 |  |  |  |  |  |
| 7 | (c)        | Is Naz correct?   |                 |  |  |  |  |  |
|   |            | Use calculations to show how you decide.  | [3 marks]       |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |
|   |            | Answer  | _               |  |  |  |  |  |
|   |            |   |                 |  |  |  |  |  |

| 8 | (a) | Solve the inequality $\frac{1}{2}x + 9 > 3(x - 2)$             | [2 marks] |
|---|-----|--|-----------|
|   |     |  |           |
| 8 | (b) | AnswerRepresent your solution to part (a) on this number line. | _         |
|   |     | -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 x                        |           |
| 8 | (c) | Solve the inequality $x^2 \ge 16$                              | [1 mark]  |
|   |     |  |           |
|   |     | Answer   | _         |
|   |     |  |           |

| 9  | Circle the best estima  | te for the value                     | of                |                    |               |  |
|----|---|--------------------------------------|-------------------|--------------------|---------------|--|
|    | $\sqrt{26}$   | $(\frac{5}{6} + 1.98)$ $(9)^2 - 8.3$ |                   |                    |               |  |
|    | (5.9  | $(9)^2 - 8.3$                        |                   |                    | [1 mark]      |  |
|    | -8  | -3.5                                 | 0.25              | 1.4                | [1 mark]      |  |
|    | <del>-</del> o  | <b>-</b> 3.5                         | 0.25              | 1.4                |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
| 10 | Jen spends $\frac{3}{8}$ of her i   | ncome on rent.                       |                   |                    |               |  |
|    |   |                                      |                   | food and other liv | ving evnenses |  |
|    | $\frac{6}{11}$ of the money she has left after paying rent goes on food and other living expenses.<br>She saves the rest of her income. |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    |   |                                      |                   |                    |               |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   | of her total inco                    | ome that Jen save | S.                 | [3 marks]     |  |
|    | Work out the fraction   |                                      |                   |                    |               |  |
|    | Work out the fraction   |                                      |                   | S.                 |               |  |
|    | Work out the fraction   |                                      |                   |                    |               |  |
|    | Work out the fraction   |                                      |                   |                    |               |  |
|    | Work out the fraction   |                                      |                   |                    |               |  |

11 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.

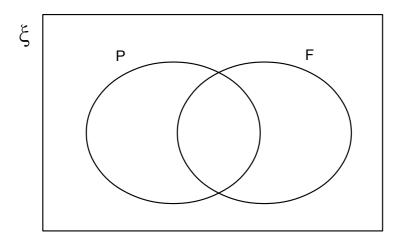
The total number of fiction books is 10 more than the total number of books with a paperback cover.

**11 (a)** Complete the Venn diagram representing this information.

 $\xi$  = books that Tim owns

P = books with a paperback cover

F = fiction books



| LJ | ma   | arl | /e1 |
|----|------|-----|-----|
| IJ | 1114 | are | 15  |

**11 (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.

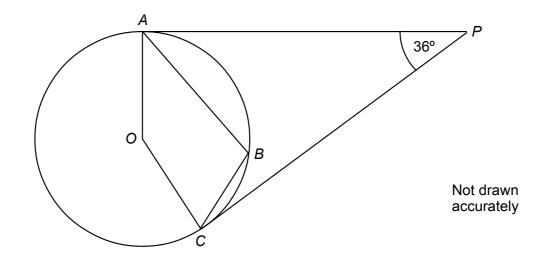
| [1 | mark] |
|----|-------|
|----|-------|

| ∆newer  |  |  |  |
|---------|--|--|--|
| 3119W21 |  |  |  |

| 12 | The functions f and g are such that |   |           |  |
|----|-------------------------------------|---|-----------|--|
|    |                                     | $f(x) = \frac{x+1}{2}$ and $g(x) = \frac{3}{x}$ |           |  |
|    | Find                                | d the value of                                  |           |  |
| 12 | (a)                                 | f(11)   | [1 mark]  |  |
| 40 | 41-3                                | Answer  | _         |  |
| 12 | (D)                                 | g <sup>-1</sup> (9)                             | [2 marks] |  |
|    |                                     |   |           |  |
|    |                                     | Answer  | _         |  |
| 12 | (c)                                 | $gf(\frac{1}{2})$                               | [2 marks] |  |
|    |                                     |   |           |  |
|    |                                     |   |           |  |
|    |                                     |   |           |  |
|    |                                     | Answer  | _         |  |
|    |                                     |   |           |  |
|    |                                     |   |           |  |
|    |                                     |   |           |  |

| 13 | (a) | There are three-quarters of a million bacteria in a dish. |                        |                        |            |          |  |
|----|-----|---|------------------------|------------------------|------------|----------|--|
|    |     | The number of bacteria doubles every 40 minutes.          |                        |                        |            |          |  |
|    |     | Circle the number of bac                                  | cteria there will be i | n the dish after 4 hoເ | ırs.       | P4 1-9   |  |
|    |     |   |                        |                        |            | [1 mark] |  |
|    |     | 12 million  | 24 million             | 48 million             | 96 million |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
| 13 | (b) | The value, £ <i>P</i> , of a car a                        | ofter Tyears is give   | on by the formula      |            |          |  |
| 13 | (D) |   |                        | in by the formula      |            |          |  |
|    |     | P = 8000 × 0  |                        |                        |            |          |  |
|    |     | Circle the annual percer                                  | itage decrease in t    | ne value of the car.   |            | [1 mark] |  |
|    |     | 0.63% 37% 50.4% 63%                                       |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |
|    |     |   |                        |                        |            |          |  |

| 14<br>14 |     | $(9.3 \times 10^7) + (8 \times 10^7)$        | nber in standard form<br>10 <sup>6</sup> ) |           |
|----------|-----|--|--|-----------|
|          | . , |  | •  | [2 marks] |
|          |     |  |  |           |
|          |     |  | Answer                                     |           |
| 14       | (b) | $\frac{4.2 \times 10^4}{1.4 \times 10^{-6}}$ |  |           |
|          |     |  |  | [2 marks] |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  | Answer                                     |           |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  |  |           |
|          |     |  |  |           |



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 <i>ABC</i> = 108°. |  |
|-------------------------------------|--|
|                                     |  |

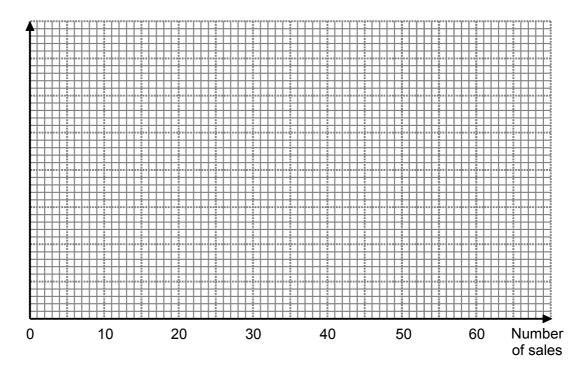
| [3 marks] |
|-----------|
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |
|           |

| 16 | 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 marks]   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    | Answer  |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |
|    |   |

17 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 ≤ S < 30         | 5              |
| 30 ≤ S < 40         | 8              |
| 40 ≤ S < 45         | 9              |
| 45 ≤ S < 50         | 6              |
| 50 ≤ S < 60         | 2              |

17 (a) On the grid, draw a histogram for the information in the table.



[3 marks]

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

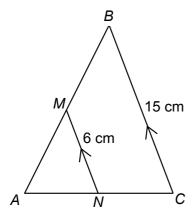
| Г.,, |              |     |                         |                   |                         |                      |                |                |           |                 |
|------|--------------|-----|-------------------------|-------------------|-------------------------|----------------------|----------------|----------------|-----------|-----------------|
| d    | eque<br>lens | ity |                         |                   |                         |                      |                |                |           |                 |
|      |              | 1.5 |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
|      |              | 1.0 |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
|      |              | 0.5 |                         |                   |                         |                      |                |                |           |                 |
|      |              | 0.5 |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
|      |              | 0   |                         | 10                | 20                      | 20                   | 40             | 50             | 60        | Number          |
|      |              |     | 0                       | 10                | 20                      | 30                   | 40             | 50             | 60        | Number of sales |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
| 17   | (b)          | S   | sy compar<br>successful | nng the two<br>I. | nistogran               | ns, comm             | ent on wheth   | ier or not the | advertin  |                 |
|      |              |     |                         |                   |                         |                      |                |                |           | [1 mark]        |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
| 17   | (c)          | F   | For the 30 sold 35 or   | days after to     | the advert<br>e machine | t, estimate<br>s.    | e the number   | of days on v   | vhich the | company         |
|      |              |     |                         |                   |                         |                      |                |                |           | [2 marks]       |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   | Answ                    | ver                  |                |                |           | days            |
| 17   | (4)          | _   | Evoloio wh              | N VOUR OPO        | vor to nor              | t (a) is on          | lv an actimat  | •              |           |                 |
| 17   | (d)          |     | expiairi wi             | ly your arist     | wer to par              | t ( <b>c</b> ) is or | lly an estimat | e.             |           | [1 mark]        |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              | _   |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |
|      |              |     |                         |                   |                         |                      |                |                |           |                 |

18 ----- 21 cm -Not drawn accurately Ε D **←**-----8 cm ------AC and ED are parallel lines. B lies on AC and AC = 21 cm. BD = BE = DE = 8 cm.Angle BDC = 90°. Show that the perimeter of trapezium ACDE can be written in the form  $(a + b\sqrt{3})$  cm, where a and b are integers. [5 marks]

cm

Answer \_

19



Not drawn accurately

Circle the ratio of the area of triangle AMN to the area of quadrilateral BCNM.

[1 mark]

- 2:5
- 4:21
- 4:25
  - 8:117

**20** (a) Evaluate  $27^{\frac{2}{3}}$ 

| [2 | mar | ks] |
|----|-----|-----|
|----|-----|-----|

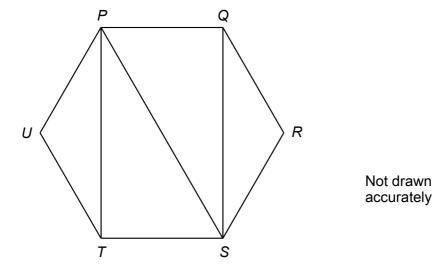
Answer \_\_\_\_\_

**20 (b)** Find the value of *x* for which

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

[3 marks]

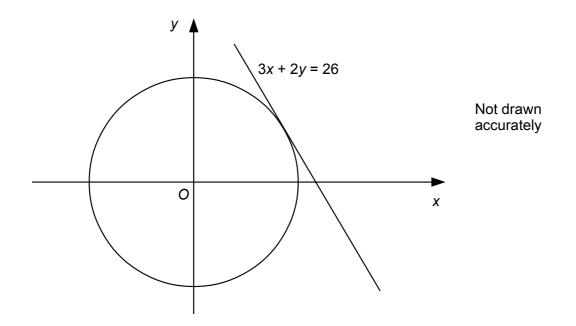
Answer \_\_\_\_\_



PQRSTU is a regular hexagon.

| Prove that triangle <i>PQS</i> is congruent to triangle <i>STP</i> . | [3 marks] |
|--|-----------|
|  |           |
|  |           |
|  |           |
|  |           |
|  |           |
|  |           |

22



The line with equation 3x + 2y = 26 is a tangent to a circle with centre (0, 0).

| Find the equation of the circle. | [5 marks] |
|----------------------------------|-----------|
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  | _         |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |
|                                  |           |

Answer

| 23 | 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. | [5 marks] |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    | a =                                     |           |  |  |  |
|    | b =                                     |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    | END OF QUESTIONS                        |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |
|    |   |           |  |  |  |