Instructions

- Use black ink or ball-point pen.
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- Calculators must not be used.

Information

- The total mark for this paper is 100
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Questions labelled with an asterisk (*) are ones where the quality of your written communication will be assessed.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.
GCSE Mathematics 1MA0

Formulae: Higher Tier

You must not write on this formulae page. Anything you write on this formulae page will gain NO credit.

Volume of prism = area of cross section × length

Area of trapezium = \( \frac{1}{2} (a + b)h \)

Volume of sphere = \( \frac{4}{3} \pi r^3 \)

Volume of cone = \( \frac{1}{3} \pi r^2 h \)

Surface area of sphere = \( 4\pi r^2 \)

Curved surface area of cone = \( \pi rl \)

In any triangle \( ABC \)

The Quadratic Equation
The solutions of \( ax^2 + bx + c = 0 \) where \( a \neq 0 \), are given by

\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

Sine Rule \( \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \)

Cosine Rule \( a^2 = b^2 + c^2 - 2bc \cos A \)

Area of triangle = \( \frac{1}{2} ab \sin C \)
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

You must NOT use a calculator.

1. Work out $1.83 \times 47$

(Total for Question 1 is 3 marks)
The scatter graph shows information about 10 apartments in a city.

The graph shows the distance from the city centre and the monthly rent of each apartment.

The table shows the distance from the city centre and the monthly rent for two other apartments.

<table>
<thead>
<tr>
<th>Distance from the city centre (km)</th>
<th>2</th>
<th>3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly rent (£)</td>
<td>250</td>
<td>190</td>
</tr>
</tbody>
</table>

(a) On the scatter graph, plot the information from the table.

(b) Describe the relationship between the distance from the city centre and the monthly rent.
An apartment is 2.8 km from the city centre.

(c) Find an estimate for the monthly rent for this apartment.

£ ......................................................

(Total for Question 2 is 4 marks)

3  Paula wants to find out how much money people spend buying CDs.

She uses this question on a questionnaire.

How much money do you spend buying CDs?

[ ] £10 – £30  [ ] £30 – £50  [ ] £50 – £70  [ ] more than £70

(a) Write down two things wrong with this question.

1 .............................................................................................................................. ..............................................................................................................

............................................................................................................................... ...................................................................................................................

2 .............................................................................................................................. ..............................................................................................................

............................................................................................................................... ...................................................................................................................

(b) Her sample is biased.

Explain why.

............................................................................................................................... ...................................................................................................................

............................................................................................................................... ...................................................................................................................

(Paula asks 100 people in a CD store to do her questionnaire.

(b) Her sample is biased.

Explain why.

............................................................................................................................... ...................................................................................................................

............................................................................................................................... ...................................................................................................................

(Total for Question 3 is 3 marks)
4. (a) Complete the table of values for \( y = 2x + 5 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) On the grid, draw the graph of \( y = 2x + 5 \) for values of \( x \) from \( x = -2 \) to \( x = 2 \)

(Total for Question 4 is 4 marks)
5 Here are the first 5 terms of an arithmetic sequence.

\[ 3 \quad 9 \quad 15 \quad 21 \quad 27 \]

(a) Find an expression, in terms of \( n \), for the \( n \)th term of this sequence.

Ben says that 150 is in the sequence.

(b) Is Ben right?
   You must explain your answer.

(Total for Question 5 is 3 marks)
6 You can use this conversion graph to change between pounds (£) and dollars ($).

(a) Use the conversion graph to change £5 to dollars.

$ ....................................

(1)

Ella has $200 and £800
Her hotel bill is $600
Ella pays the bill with the $200 and some of the pounds.

(b) Use the conversion graph to work out how many pounds she has left.

£ ....................................

(4)

(Total for Question 6 is 5 marks)
7 (a) Simplify $5x + 4y + x - 7y$

(b) Solve $7(x + 2) = 7$

(Total for Question 7 is 4 marks)
8 Trams leave Piccadilly

to Eccles every 9 minutes

to Didsbury every 12 minutes

A tram to Eccles and a tram to Didsbury both leave Piccadilly at 9 am.

At what time will a tram to Eccles and a tram to Didsbury next leave Piccadilly at the same time?

(Total for Question 8 is 3 marks)

9 (a) Simplify \(a^4 \times a^5\)

(b) Simplify \(\frac{45e^6 f^8}{5ef^2}\)

(c) Write down the value of \(9^\frac{1}{2}\)

(Total for Question 9 is 4 marks)
$CDEF$ is a straight line. 
$AB$ is parallel to $CF$. 
$DE = AE$. 

Work out the size of the angle marked $x$. 
You must give reasons for your answer.
11 Greg sells car insurance and home insurance.

The table shows the cost of these insurances.

<table>
<thead>
<tr>
<th>Insurance</th>
<th>car insurance</th>
<th>home insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>£200</td>
<td>£350</td>
</tr>
</tbody>
</table>

Each month Greg earns

- £530 basic pay
- 5% of the cost of all the car insurance he sells
- and 10% of the cost of all the home insurance he sells

In May Greg sold

- 6 car insurances
- and 4 home insurances

Work out the total amount of money Greg earned in May.
£ ....................................

(Total for Question 11 is 5 marks)
12 5 schools sent some students to a conference.

One of the schools sent both boys and girls.
This school sent 16 boys.
The ratio of the number of boys it sent to the number of girls it sent was 1 : 2

The other 4 schools sent only girls.
Each of the 5 schools sent the same number of students.

Work out the total number of students sent to the conference by these 5 schools.
The diagram shows a square and 4 regular pentagons.

Work out the size of the angle marked \( x \).

Diagram NOT accurately drawn

(Total for Question 13 is 3 marks)
The grouped frequency table shows information about the weekly wages of 80 factory workers.

<table>
<thead>
<tr>
<th>Weekly wage (£(x))</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 &lt; (x) ≤ 200</td>
<td>8</td>
</tr>
<tr>
<td>200 &lt; (x) ≤ 300</td>
<td>15</td>
</tr>
<tr>
<td>300 &lt; (x) ≤ 400</td>
<td>30</td>
</tr>
<tr>
<td>400 &lt; (x) ≤ 500</td>
<td>17</td>
</tr>
<tr>
<td>500 &lt; (x) ≤ 600</td>
<td>7</td>
</tr>
<tr>
<td>600 &lt; (x) ≤ 700</td>
<td>3</td>
</tr>
</tbody>
</table>

(a) Complete the cumulative frequency table.

<table>
<thead>
<tr>
<th>Weekly wage (£(x))</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 &lt; (x) ≤ 200</td>
<td></td>
</tr>
<tr>
<td>100 &lt; (x) ≤ 300</td>
<td></td>
</tr>
<tr>
<td>100 &lt; (x) ≤ 400</td>
<td></td>
</tr>
<tr>
<td>100 &lt; (x) ≤ 500</td>
<td></td>
</tr>
<tr>
<td>100 &lt; (x) ≤ 600</td>
<td></td>
</tr>
<tr>
<td>100 &lt; (x) ≤ 700</td>
<td></td>
</tr>
</tbody>
</table>

(b) On the grid opposite, draw a cumulative frequency graph for your table.

(c) Use your graph to find an estimate for the interquartile range.

£ ........................................

(d) Use your graph to find an estimate for the number of workers with a weekly wage of more than £530

........................................
Cumulative frequency

Weekly wage (£)

(Total for Question 14 is 7 marks)
Here is a scale drawing of a rectangular garden $ABCD$.

Jane wants to plant a tree in the garden

- at least 5 m from point $C$,
- nearer to $AB$ than to $AD$
- and less than 3 m from $DC$.

On the diagram, shade the region where Jane can plant the tree.

(Total for Question 15 is 4 marks)
16 (a) Write $8.2 \times 10^5$ as an ordinary number.

............................................................................................... (1)

(b) Write 0.000 376 in standard form.

............................................................................................... (1)

(c) Work out the value of $(2.3 \times 10^{12}) \div (4.6 \times 10^3)$
    Give your answer in standard form.

............................................................................................... (2)

(Total for Question 16 is 4 marks)

17 Solve $\frac{4x - 1}{5} + \frac{x + 4}{2} = 3$

$x = ........................................$

(Total for Question 17 is 3 marks)
Shape $P$ is reflected in the line $x = -1$ to give shape $Q$.

Shape $Q$ is reflected in the line $y = 0$ to give shape $R$.

Describe fully the single transformation that maps shape $P$ onto shape $R$.

(Total for Question 18 is 3 marks)
$A$, $B$ and $D$ are points on the circumference of a circle, centre $O$.
$BOD$ is a diameter of the circle.
$BC$ and $AC$ are tangents to the circle.
Angle $OCB = 34^\circ$.

Work out the size of angle $DOA$. 

(Total for Question 19 is 3 marks)
20 (a) (i) Factorise  \( x^2 - 12x + 27 \)

(ii) Solve the equation  \( x^2 - 12x + 27 = 0 \)

(b) Factorise  \( y^2 - 100 \)

(Total for Question 20 is 4 marks)

21 Prove algebraically that the difference between the squares of any two consecutive integers is equal to the sum of these two integers.

(Total for Question 21 is 4 marks)
Enlarge the shaded shape by scale factor $\frac{1}{2}$ with centre $(-1, -2)$.

(Total for Question 22 is 3 marks)
23 The diagram shows a solid hemisphere of radius 5 cm.

Find the total surface area of the solid hemisphere.
Give your answer in terms of $\pi$.

\[ \text{cm}^2 \]

(Total for Question 23 is 3 marks)
24 There are three different types of sandwiches on a shelf.

There are

4 egg sandwiches,
5 cheese sandwiches
and 2 ham sandwiches.

Erin takes at random 2 of these sandwiches.

Work out the probability that she takes 2 different types of sandwiches.
25 \( y = f(x) \)

The graph of \( y = f(x) \) is shown on the grid.

(a) On the grid above, sketch the graph of \( y = -f(x) \).

The graph of \( y = f(x) \) is shown on the grid.

The graph \( G \) is a translation of the graph of \( y = f(x) \).

(b) Write down the equation of graph \( G \).

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(Total for Question 25 is 3 marks)
OAYB is a quadrilateral.
\[ \overrightarrow{OA} = 3a \]
\[ \overrightarrow{OB} = 6b \]

(a) Express \( \overrightarrow{AB} \) in terms of \( a \) and \( b \).

\[ \text{Diagram NOT accurately drawn} \]

\[ \overrightarrow{OX} = \frac{2}{5} \overrightarrow{OY} \]

(Total for Question 26 is 5 marks)