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.
• Without sufficient working, correct answers may be awarded no marks.
• Answer the questions in the spaces provided
  – there may be more space than you need.
• Calculators may be used.
• You must NOT write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

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.

Advice

• Read each question carefully before you start to answer it.
• Check your answers if you have time at the end.
International GCSE MATHEMATICS
FORMULAE SHEET – HIGHER TIER

Pythagoras’ Theorem
\[ a^2 + b^2 = c^2 \]

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

Volume of sphere = \( \frac{4}{3} \pi r^3 \)
Surface area of sphere = \( 4\pi r^2 \)

\[ \text{adj} = \text{hyp} \times \cos \theta \]
\[ \text{opp} = \text{hyp} \times \sin \theta \]
\[ \text{opp} = \text{adj} \times \tan \theta \]

or \[ \sin \theta = \frac{\text{opp}}{\text{hyp}} \]
\[ \cos \theta = \frac{\text{adj}}{\text{hyp}} \]
\[ \tan \theta = \frac{\text{opp}}{\text{adj}} \]

Circumference of circle = \( 2\pi r \)
Area of circle = \( \pi r^2 \)

Volume of cylinder = \( \pi r^2 h \)
Curved surface area of cylinder = \( 2\pi rh \)

In any triangle \( ABC \)

\[ \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \]

Sine rule:
Cosine rule: \( a^2 = b^2 + c^2 - 2bc \cos A \)
Area of triangle = \( \frac{1}{2}ab \sin C \)

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

The Quadratic Equation
The solutions of \( ax^2 + bx + c = 0 \), where \( a \neq 0 \), are given by
\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
1 Here are the ingredients needed to make 12 muffins.

<table>
<thead>
<tr>
<th>Ingredients to make 12 muffins</th>
</tr>
</thead>
<tbody>
<tr>
<td>300g flour</td>
</tr>
<tr>
<td>150g sugar</td>
</tr>
<tr>
<td>250ml milk</td>
</tr>
<tr>
<td>100g butter</td>
</tr>
<tr>
<td>2 eggs</td>
</tr>
</tbody>
</table>

Sarah makes 60 muffins.

(a) Work out how much sugar she uses.

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

(2) g

James makes some muffins.
He uses 625 ml of milk.

(b) How many muffins did he make?

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

(2)

(Total for Question 1 is 4 marks)
2  \( a = -5 \)  
   \( c = -2 \)

(a) Work out the value of \( 2a^2 + 6c \)

There are 4 pens in a small box of pens.  
There are 10 pens in a large box of pens.

Ami buys \( x \) small boxes of pens and \( y \) large boxes of pens.  
She buys a total of \( T \) pens.

(b) Write down a formula for \( T \) in terms of \( x \) and \( y \).
3  The table shows information about the number of visits each of 40 adults made to the
gym last week.

<table>
<thead>
<tr>
<th>Number of visits to the gym</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Work out the mean of the number of visits to the gym.

(Total for Question 3 is 3 marks)

4  \( A = \{2, 4, 6, 8, 10, 12, 14\} \)
\( B = \{1, 3, 5, 7, 9, 11, 13\} \)
\( C = \{3, 6, 9, 12\} \)

(a) List the members of the set
(i) \( A \cap C \)

(ii) \( A \cup C \)

(b) Explain why \( A \cap B = \emptyset \)

(Total for Question 4 is 3 marks)
5. On the grid, draw the graph of \( y = 3x - 5 \) for values of \( x \) from \(-2\) to \(3\). 

(Total for Question 5 is 4 marks)
6 (a) Show that \( \frac{3}{10} + \frac{2}{15} = \frac{13}{30} \) 

(b) Show that \( 2 \frac{5}{8} + 1 \frac{1}{6} = 2 \frac{1}{4} \) 

(Total for Question 6 is 5 marks)
7  (a) Factorise \(3y^2 + 2y\)

(b) Expand and simplify \((x - 9)(x + 2)\)

(c) (i) Solve \(6k + 5 < 20\)

(ii) \(n\) is an integer and \(6n + 5 < 20\)

Write down the largest possible value of \(n\)

(d) Simplify fully \(\frac{28x^5y^3}{4xy^2}\)

(Total for Question 7 is 8 marks)
Work out the length of \( AB \).

Give your answer correct to 1 decimal place.

\[
\text{\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots cm}
\]

(Total for Question 8 is 3 marks)
Bhavin, Max and Imran share 6000 rupees in the ratios 2 : 3 : 7.

Imran then gives \( \frac{3}{5} \) of his share of the money to Bhavin.

What percentage of the 6000 rupees does Bhavin now have?
Give your answer correct to the nearest whole number.

(\text{Total for Question 9 is 5 marks})
10 The diagram shows a circle inside a rectangle.

Diagram NOT accurately drawn

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

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

......................... cm$^2$

(Total for Question 10 is 3 marks)
11 The frequency table shows information about the weights of 80 adults.

<table>
<thead>
<tr>
<th>Weight (w kg)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$40 &lt; w \leq 50$</td>
<td>4</td>
</tr>
<tr>
<td>$50 &lt; w \leq 60$</td>
<td>7</td>
</tr>
<tr>
<td>$60 &lt; w \leq 70$</td>
<td>21</td>
</tr>
<tr>
<td>$70 &lt; w \leq 80$</td>
<td>21</td>
</tr>
<tr>
<td>$80 &lt; w \leq 90$</td>
<td>18</td>
</tr>
<tr>
<td>$90 &lt; w \leq 100$</td>
<td>7</td>
</tr>
<tr>
<td>$100 &lt; w \leq 110$</td>
<td>2</td>
</tr>
</tbody>
</table>

(a) Complete the cumulative frequency table.

<table>
<thead>
<tr>
<th>Weight (w kg)</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$40 &lt; w \leq 50$</td>
<td>4</td>
</tr>
<tr>
<td>$40 &lt; w \leq 60$</td>
<td>11</td>
</tr>
<tr>
<td>$40 &lt; w \leq 70$</td>
<td>32</td>
</tr>
<tr>
<td>$40 &lt; w \leq 80$</td>
<td>53</td>
</tr>
<tr>
<td>$40 &lt; w \leq 90$</td>
<td>72</td>
</tr>
<tr>
<td>$40 &lt; w \leq 100$</td>
<td>79</td>
</tr>
<tr>
<td>$40 &lt; w \leq 110$</td>
<td>81</td>
</tr>
</tbody>
</table>
(b) On the grid, draw a cumulative frequency graph for your table.

(c) Use your graph to find an estimate for the number of adults with weight more than 85 kg.

(d) Use your graph to find an estimate for the interquartile range of the weights of the adults.

(Total for Question 11 is 7 marks)
12 Solve the simultaneous equations

\[4x + 5y = 13\]
\[3x - 2y = 27\]

Show clear algebraic working.

\[x = \ldots\]
\[y = \ldots\]

(Total for Question 12 is 4 marks)
13 The straight line \( L \) passes through the points \((-2, 3) \) and \((6, 9)\)

Find an equation of the line that is parallel to \( L \) and passes through the point \((5, -1)\)
Give your answer in the form \( ax + by = c \) where \( a, b \) and \( c \) are integers.
A particle is moving along a straight line. The fixed point $O$ lies on this line. The displacement of the particle from $O$ at time $t$ seconds is $s$ metres where

$$s = 2t^3 - 12t^2 + 7t$$

(a) Find an expression for the velocity, $v$ m/s, of the particle at time $t$ seconds.

$$v = .....................$$

(b) Find the time at which the acceleration of the particle is instantaneously zero.

......................... seconds

(Total for Question 14 is 4 marks)
The diagram shows two mathematically similar vases, A and B.

Vase A has a surface area of 120 cm\(^2\)
Vase B has a surface area of 750 cm\(^2\) and a volume of 1600 cm\(^3\)

Work out the volume of vase A.

\[ \text{cm}^3 \]

(Total for Question 15 is 3 marks)
16 \( ABCDEFGH \) is a cuboid.

The cuboid has
- length 17 cm
- width 5 cm
- height 8 cm

Work out the size of the angle that \( AH \) makes with the plane \( EFGH \).
Give your answer correct to 1 decimal place.

(Total for Question 16 is 4 marks)
17 The diagram shows a trapezium.

![Diagram of a trapezium with measurements](image)

All measurements on the diagram are in centimetres.

The area of the trapezium is 119 cm²

(i) Show that \(2x^2 - x - 120 = 0\)

(ii) Find the value of \(x\).

Show your working clearly.

\[x = \ldots\]
18 Make \( t \) the subject of the formula \( m = \frac{t + 1}{t - 3} \)

(Total for Question 18 is 4 marks)
A, B, C and D are points on a circle, centre O.

Angle $DAB = 75^\circ$
Angle $DBC = 27^\circ$

Work out the size of angle $ODC$. 

\[ \text{(Total for Question 19 is 4 marks)} \]
A metal cube has sides of length 4.5 cm, correct to the nearest 0.5 cm.

The cube is melted down and the metal is used to make small spheres. Each sphere has a radius of 3 mm, correct to the nearest millimetre.

Work out the greatest number of spheres that could be made from the metal. Show your working clearly.
21 There are 9 counters in a bag. 
There is a number on each counter.

Kal takes at random 3 counters from the bag.

He adds together the numbers on the 3 counters to get his Total.

Work out the probability that his Total is 6

(Total for Question 21 is 5 marks)
22 The diagram shows a pentagon.

Work out the area of the pentagon.
Give your answer correct to 3 significant figures.

\[
\text{\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots cm}^2
\]

(Total for Question 22 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS