London Examinations IGCSE
Mathematics
Paper 3H
Higher Tier
Thursday 11 November 2010 – Morning
Time: 2 hours

Materials required for examination
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator.
Tracing paper may be used.

Items included with question papers
Nil

Instructions to Candidates
In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Without sufficient working, correct answers may be awarded no marks.
You must NOT write on the formulae page. Anything you write on the formulae page will gain NO credit.
If you need more space to complete your answer to any question, use additional answer sheets.

Information for Candidates
The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).
There are 21 questions in this question paper. The total mark for this paper is 100.
There are 24 pages in this question paper. Any blank pages are indicated.
You may use a calculator.

Advice to Candidates
Write your answers neatly and in good English.
IGCSE MATHEMATICS 4400
FORMULA 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 = \( 4\pi r^2 \)

In any triangle \( ABC \)

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

Area of triangle = \( \frac{1}{2} ab \sin C \)

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

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

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

Area of a trapezium = \( \frac{1}{2}(a + b)h \)
1. The table shows information about the numbers of children in 25 families.

<table>
<thead>
<tr>
<th>Number of children in the family</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Work out the mean number of children in these 25 families.
2. (a) Expand

(i) \(4(c - 3)\)

(ii) \(d(d^2 + 4)\)

(b) Factorise \(3x - 2c^2\)
3. \( ABC \) is an isosceles triangle.
\( BA = BC \).
\( PA \) is parallel to \( BC \).
Angle \( ACB = 70^\circ \).

Find the value of \( x \).
Give a reason for each step in your working.

\[
x = \text{ \ldots \ldots \ldots \ldots \ldots }
\]

(Total 4 marks)
A circular pond has radius 8.9 m.

(a) Find the area of the pond.
   Write down all the figures on your calculator display.
   State the units of your answer.

..................................        .......................  (3)

(b) Give the value of your area correct to 2 significant figures.

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

(Total 4 marks)
5. (a) Show that \( \frac{6}{7} + 4 = \frac{3}{14} \)

(b) Show that \( \frac{2}{5} - \frac{2}{3} = \frac{11}{15} \)

(Total 5 marks)
6. (a) Solve \( 7x + 3 = 2x - 4 \)

\[ x = \ldots \ldots \ldots \ldots \ldots \ldots \quad (3) \]

(b) Solve \( \frac{16 - 5y}{3} = 2 \)

\[ y = \ldots \ldots \ldots \ldots \ldots \ldots \quad (3) \]

(Total 6 marks)
7. \( \mathcal{E} = \{\text{Clothes}\} \)
\(A = \{\text{Mr Smith's clothes}\}\)
\(B = \{\text{Hats}\}\)
\(C = \{\text{Mrs Koshi's hats}\}\)

(a) (i) Describe the members of the set \(A \cap B\)
..............................................................................
..............................................................................

(ii) How many members has the set \(A \cap C\)?
.................................

(b)

Use a letter or symbol from the box to make each of the following a true statement.

(i) \(B \cup C = \ldots \ldots \ldots \ldots \ldots \ldots \)

(ii) Mr Smith’s favourite shirt \(\ldots \ldots \ldots \ldots \ldots \ldots A\)

(Total 4 marks)
8. (a) Calculate the value of \( x \).
Give your answer correct to 3 significant figures.

\[ x = \ldots \] (3)

(b) Calculate the value of \( y \).
Give your answer correct to 3 significant figures.

\[ y = \ldots \] (3)
9. (a) Three positive whole numbers are all different.
    They have a median of 5 and a mean of 4
    Find the three numbers.

(b) Find four whole numbers which have a mode of 5 and a median of 6

(Total 4 marks)
10. Here are two similar triangles.

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

\[ \text{\(LM\) corresponds to \(PQ\).} \]
\[ \text{\(MN\) corresponds to \(QR\).} \]

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

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

(b) Find the value of \(y\).

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

(Total 4 marks)
11. The cumulative frequency graph gives information about the lengths of 40 tree branches.

(a) Find an estimate for the median length.

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

(b) Find an estimate for the interquartile range of the lengths.

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

(c) Find an estimate for the number of branches with lengths of more than 44 cm.

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

(Total 5 marks)
12. Solve the simultaneous equations

\[2x - 5y = 13\]
\[6x + 3y = 3\]

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

13. (a) Factorise \(x^2 - 8x + 15\)

\[\ldots\]

(2)

(b) Factorise \(x^2 - 49\)

\[\ldots\]

(1)

(Total 3 marks)
14. The diagram shows the graph of \( y = x^2 - 4x + 3 \) for \(-1 \leq x \leq 5\)

(a) Use the graph to solve the equation \( x^2 - 4x + 3 = 2 \)

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

(2)

(b) By drawing a suitable straight line on the diagram, solve the equation \( x^2 - 4x + 3 = x + 1 \)

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

(3)

(Total 5 marks)
15. A solid is made from a cylinder and a hemisphere. 
The cylinder has radius 1.5 cm and height 4 cm. 
The hemisphere has radius 1.5 cm.

Diagram NOT accurately drawn

Work out the total volume of the solid. 
Give your answer correct to 3 significant figures.

.......................... cm$^3$  
(Total 5 marks)
16. A curve has equation \( y = x^3 + 3x^2 - 24x \)

(a) Find \( \frac{dy}{dx} \) ...................................... (3)

(b) Find the coordinates of the turning points of the curve.
17. Here is a fair dice.

It has six faces numbered 1, 2, 3, 4, 5 and 6
The dice shows a score of 6
Hari throws the dice three times.
(a) Work out the probability that the sum of the scores is 3

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

(b) Work out the probability that the dice shows a score of 1 on exactly one of the three throws.

......................................
(3)

(Total 5 marks)
18. Make $x$ the subject of \[ P = \frac{100 (y - x)}{x} \]

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

(Total 4 marks)
Calculate the area of triangle $ABC$. Give your answer correct to 3 significant figures.

\[ \text{Area} = \frac{1}{2} \times 6 \text{ cm} \times 5 \text{ cm} \times \sin(40^\circ) \]

\[ \text{Area} \approx \text{...} \text{ cm}^2 \]
20. (a) Write \( \frac{1}{16} \) as a power of 2

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

(2)

(b) Write 2 as a power of 8

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

(2)

(c) Rationalise the denominator of \( \frac{a + \sqrt{a}}{\sqrt[a]{a}} \) where \( a \) is a prime number.

Simplify your answer as much as possible.

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

(2)

(Total 6 marks)
21. (a) \( f(x) = 2x + 1 \)

Express the inverse function \( f^{-1} \) in the form \( f^{-1}(x) = \ldots \)

\[
f^{-1}(x) = \ldots
\]

(b) \( g(x) = 2 + x \)
\( h(x) = x^2 \)

Solve the equation \( hg(x) = h(x) \).

\[
x = \ldots
\]

(Total 5 marks)
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