Mathematics (Linear) 4365/2H

Paper 2

Friday 13 June 2014 9.00 am to 11.00 am

For this paper you must have:
- a calculator
- mathematical instruments.

Time allowed
- 2 hours

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this 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.
- Do all rough work in this book.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- The quality of your written communication is specifically assessed in Questions 3, 10, 13, 17 and 25. These questions are indicated with an asterisk (*).
- You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

Advice
- In all calculations, show clearly how you work out your answer.
Formulae Sheet: Higher Tier

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

Volume of prism = area of cross section \( \times \) length

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

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

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

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

In any triangle \( ABC \)

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

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

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

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

\[
x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}
\]
Answer **all** questions in the spaces provided.

1. Here is a list of what you need to make 20 buns.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>butter</td>
<td>180 g</td>
</tr>
<tr>
<td>flour</td>
<td>150 g</td>
</tr>
<tr>
<td>sugar</td>
<td>200 g</td>
</tr>
<tr>
<td>eggs</td>
<td>4</td>
</tr>
</tbody>
</table>

Work out what you need to make 30 buns.

   [3 marks]

   ...............................................................  g butter
   ...............................................................  g flour
   ...............................................................  g sugar
   ...............................................................  eggs
2 In a kettle, there are \(1\frac{3}{5}\) litres of water.

A cup holds \(\frac{1}{5}\) of a litre of water.

How many cups can be filled with the water in the kettle? [2 marks]

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Answer ...........................................................
Here are two games that can be played with ordinary six-sided fair dice.

Game A
Roll two dice
Add the numbers
The total is your score

Game B
Roll one dice
The number you get is your score

Which game gives a higher chance of scoring 6?
You must show your working.

Answer ......................................................................
Here is a right-angled triangle.

Four of these triangles are joined to make a square as shown.

Work out the area of the square.

[3 marks]

Answer ......................................................... cm$^2$
5 This is a regular pentagon.

5 (a) Work out the size of angle $x$. [2 marks]

Answer ........................................................ degrees

5 (b) Which of the following is correct? Circle your answer. [1 mark]

$x + y = 360 \quad y = \frac{540}{x} \quad 5y = 540 \quad y = 2x \quad y = x - 180$
Here is a map of Sardinia.

Scale: 1 cm represents 25 km

6 (a) Work out the **actual** distance between Cagliari and Sassari. [3 marks]

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Answer ................................................................. km
6 (b) Mario's favourite beach is on a bearing of 165° from Olbia.

Draw this bearing and mark with a cross the position of the beach. [2 marks]

Turn over for the next question
7 (a) Reflect the triangle in the line \( y = 5 \) 

[2 marks]
7 (b) Describe fully the **single** transformation that takes shape A to shape B.

[Diagram of shapes A and B with grid]

[3 marks]
8 In this diagram, $AB$ is parallel to $CD$.

8 (a) Tick one correct statement for the angles shown on the diagram. [1 mark]

- Angle $x$ is equal to $144^\circ$ because they are alternate angles.
- Angle $x$ is equal to $144^\circ$ because they are vertically opposite angles.
- Angle $x$ is equal to $144^\circ$ because they are corresponding angles.

8 (b) Show that triangle $EDF$ is isosceles. You must show your working. [3 marks]

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9 (a) Factorise \( a^2 - 3a \) \[1 \text{ mark}\]

Answer ..............................................................................................

9 (b) Solve \( 7y + 4 = 3(y + 6) \) \[3 \text{ marks}\]

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\( y = \) .............................................................................................

Turn over for the next question
Jack sees the bicycle he wants to buy in two shops.

**Bye-cycles**
- Price without VAT: £130
- VAT is 20%

**Just Bykes**
- Normal price: £195
- Now \( \frac{1}{4} \) off
- VAT is included

In which shop is the bicycle cheaper?
You **must** show your working.

[5 marks]

Answer: __________________________________________________________
The table shows the GCSE Mathematics results of the students in a school.

<table>
<thead>
<tr>
<th>Grade</th>
<th>U</th>
<th>G</th>
<th>F</th>
<th>E</th>
<th>D</th>
<th>C</th>
<th>B</th>
<th>A</th>
<th>A*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>0</td>
<td>14</td>
<td>30</td>
<td>53</td>
<td>37</td>
<td>41</td>
<td>22</td>
<td>28</td>
<td>17</td>
</tr>
</tbody>
</table>

Work out the percentage of students with grade C or higher.
Give your answer to 3 significant figures.

Answer .................................................................. %

Turn over for the next question
These expressions represent four numbers. The value of the median of the expressions is 12.

\[ x \quad 2x \quad 6x \quad 11x \]

Work out the value of the mean of the expressions. [5 marks]

Answer

\[ \text{Answer} \]
*13 Here are three expressions.

\[ x^3 - 30 \]  \[ x^2 - 12 \]  \[ x - 6 \]

For one value of \( x \), all three expressions have the same value.

Use trial and improvement or any other method to work out this value of \( x \).  

\[ x = \ldots \]

Turn over for the next question
24 students took a test. The table shows information about their marks.

<table>
<thead>
<tr>
<th>Mark ($m$)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20 &lt; m \leq 40$</td>
<td>3</td>
</tr>
<tr>
<td>$40 &lt; m \leq 60$</td>
<td>5</td>
</tr>
<tr>
<td>$60 &lt; m \leq 80$</td>
<td>12</td>
</tr>
<tr>
<td>$80 &lt; m \leq 100$</td>
<td>4</td>
</tr>
</tbody>
</table>

14 (a) Draw a cumulative frequency diagram for their marks. [3 marks]
14 (b) Use the cumulative frequency diagram to estimate the interquartile range.

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Answer ......................................................................

Turn over for the next question
15 (a) The $n$th term of a sequence is $n^2 - 3$

Work out the first **three** terms of the sequence.

[2 marks]

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Answer .................................. , .................................. , ..................................

15 (b) The term-to-term rule for another sequence is

**Multiply previous term by 2 and add 1**

The second term in this sequence is $8x - 5$

Work out an expression for the first term, in terms of $x$.

[3 marks]

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Answer .................................................................................
This building block is in the shape of a cuboid.

The block contains one steel cylindrical rod of length 90 cm. The radius of the rod is 4 cm. The rest of the block is concrete.

Work out the volume of concrete in the block.

Answer ............................................................... cm$^3$
17 (a) \( P, Q, R \) and \( S \) are points on the circumference of the circle.

![Diagram with points P, Q, R, and S labeled on a circle with an angle marked x and another angle marked 124°.]

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

[1 mark]

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

Answer ........................................................ degrees

*17 (b) The diagram shows a circle and a tangent at \( T \).

![Diagram with an angle marked 70° and another angle labeled w.]

Write down the size of angle \( w \).

Give a reason for your answer.

[2 marks]

Answer ........................................................ degrees

Reason ........................................................................................................................................
A, C and D are points on the circle, centre O. BA and BC are tangents to the circle.

Work out the size of the angle \( y \).

[3 marks]

Answer ............................................. degrees

Turn over for the next question
18 (a) Complete the table of values for \( y = 2x^2 - x - 6 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>4</td>
<td>-6</td>
<td>-5</td>
<td>9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[2 marks]

18 (b) On this grid, plot the graph of \( y = 2x^2 - x - 6 \) for values of \( x \) from -2 to 3

[2 marks]

18 (c) Use your graph to find the solutions of the equation \( 2x^2 - x - 6 = 0 \)

Answer ................................ and ..................................
19  The probability that Simon passes his driving test is $\frac{3}{5}$

The probability that Kim passes her driving test is $\frac{4}{7}$

Work out the probability that at least one of them passes the driving test. [3 marks]
20 (a) Simplify \((2a^3b)^4\)  
[2 marks]

Answer ........................................................

20 (b) Expand and simplify \((2x - 3y)(5x + 2y)\)  
[3 marks]

Answer ........................................................

21 Use the quadratic formula to solve \(x^2 + 2x - 1 = 0\)  
Give your answers to 2 decimal places.  
[3 marks]

Answer ............................... and ...............................

Answer ........................................................

Answer ........................................................
You are given that \( x^2 - 12x + a = (x - c)^2 \)

Work out the values of \( a \) and \( c \). [3 marks]

\[
a = \ldots \\
c = \ldots
\]

Simplify \( \frac{5x^2 + 17x - 12}{x^2 - 16} \) [3 marks]

\[
\text{Answer} \ldots
\]
The histogram shows information about the ages of 100 employees.

Work out an estimate of the median age of the employees.

[4 marks]

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Answer ............................................................. years
The maximum safe load of a bridge is 1500 kg to the nearest 10 kg. An average soldier is 75 kg to the nearest kilogram.

Work out an estimate for the maximum number of soldiers that can safely cross the bridge at the same time.

[5 marks]

Answer: ..............................................................
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