Wednesday 6 November 2013 – Morning

GCSE MATHEMATICS A

A502/02 Unit B (Higher Tier)

INSTRUCTIONS TO CANDIDATES

• Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
• Use black ink. HB pencil may be used for graphs and diagrams only.
• Answer all the questions.
• Read each question carefully. Make sure you know what you have to do before starting your answer.
• Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
• Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
• Do not write in the bar codes.

INFORMATION FOR CANDIDATES

• The number of marks is given in brackets [ ] at the end of each question or part question.
• Your quality of written communication is assessed in questions marked with an asterisk (*).
• The total number of marks for this paper is 60.
• This document consists of 16 pages. Any blank pages are indicated.

WARNING
No calculator can be used for this paper

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Turn over
Formulae Sheet: Higher Tier

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

Volume of prism = (area of cross-section) \times \text{length}

In any triangle \( ABC \)
- 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 = \( \frac{1}{2} ab \sin C \)

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

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

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  Sukrit and Anna are playing a game called ‘Make 100’.
   Sukrit says a 2-digit number.
   Anna says the number that has to be added to this to make 100.

   For example, if Sukrit says 60, Anna says 40 as $60 + 40 = 100$.

   (a)  Complete these two games.

      Sukrit says 36, Anna says ____________

      Sukrit says 81, Anna says ____________ [1]

   (b)  They play the game 12 times.

      What should be the total of all their numbers?

      (b) ____________________________ [1]

   (c)  In another game of ‘Make 100’, their two numbers have a difference of 50.

      What are their two numbers?

      (c) _________ and __________ [1]
2 The grid shows triangle $T$. 

(a) Reflect triangle $T$ in the line $y = -1$. Label the image A. [2]

(b) Rotate triangle $T$ $180^\circ$ about the point (0, 0). Label the image B. [2]

(c) Triangle $T$ is transformed by four translations given by the following vectors.

$$\begin{pmatrix} 15 \\ -6 \end{pmatrix} \text{ then } \begin{pmatrix} 22 \\ 9 \end{pmatrix} \text{ then } \begin{pmatrix} -15 \\ 6 \end{pmatrix} \text{ then } \begin{pmatrix} -17 \\ -9 \end{pmatrix}$$

Draw the image of triangle $T$ after these four translations. Label the image C. [3]
Robin sells ice creams at a market on Thursdays and Saturdays. He records how many ice creams he sells on each of these days for 10 weeks.

<table>
<thead>
<tr>
<th>Week (Wk)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday (T)</td>
<td>56</td>
<td>60</td>
<td>62</td>
<td>67</td>
<td>66</td>
<td>64</td>
<td>72</td>
<td>74</td>
<td>77</td>
<td>78</td>
</tr>
<tr>
<td>Saturday (S)</td>
<td>88</td>
<td>84</td>
<td>81</td>
<td>63</td>
<td>78</td>
<td>85</td>
<td>80</td>
<td>84</td>
<td>86</td>
<td>83</td>
</tr>
</tbody>
</table>

(a) Complete the time series graph. The first 7 weeks have been done for you. [2]

(b) Look at the time series graph. Make two comments about Robin’s data.

(1) 

(2) 

4 Decide whether each of the following is an equation, a formula, an identity or an expression. For each one, put a tick (✓) in the correct column.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Identity</th>
<th>Formula</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V = \frac{1}{3} \pi r^2 h$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3n + 5 + 5n - 7 \equiv 8n - 2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$6n - 4 = 2n$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\pi r^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$7t^2 - t + 11$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[4]

5 Draw at least 10 crosses (✗) on each grid to produce scatter graphs that show the following.

- Strong Negative Correlation
- No Correlation

[3]
6  (a) Complete the table for $2x + 3y = 12$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>4.5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

(b) Draw the graph of $2x + 3y = 12$ for $0 \leq x \leq 6$.

(c) Use your graph to find the gradient of the line $2x + 3y = 12$.

(c) _______________________ [2]
A nail is made from a volume of 5.8 cm$^3$ of iron. The density of iron is 7.9 g/cm$^3$.

Use this formula to find the mass of the nail.

\[ \text{mass} = \text{density} \times \text{volume} \]

\[ \boxed{44.6} \text{ g} \]
8  (a)  (i)  Solve this inequality.

\[ 2m + 6 > -4 \]

(a)(i) ________________________ [2]

(ii) Represent your answer to part (a)(i) on this number line.

(b) This diagram represents the solution of another inequality.

What is the smallest integer that \( x \) can be?

(b) ________________________ [1]
9  (a) The mass of the Earth is approximately \(10^{21}\) tonnes. There are 1000 kilograms in one tonne.

What is the mass of the Earth in kilograms? Give your answer using indices.

\[\text{(a) } \underline{\text{___________________________}} \text{ kg} \quad [2]\]

(b) The mass of the planet Mercury is \(10^{23}\) kg. The mass of the planet Jupiter is \(10^{27}\) kg.

Complete this sentence.

The mass of Jupiter is \(\underline{\text{______________________}}\) times the mass of Mercury. [2]

(c) Work out.

\[100^{\frac{1}{2}}\]

\[\text{(c) } \underline{\text{_____________________________}} \quad [3]\]
Work out.

\[ \frac{2}{3} \div \frac{3}{4} \]
Chanre sews edging onto curtains and blinds. She is paid £C for each pair of curtains and £B for each set of blinds.

On Monday she completes 10 pairs of curtains and 2 sets of blinds. She is paid £35 for this.

This gives the equation $10C + 2B = 35$.

(a) On Tuesday she completes 5 pairs of curtains and 6 sets of blinds. She is paid £30 for this.

Write an equation to show this information.

(a) ____________________________ [1]

(b) Solve the two simultaneous equations algebraically to find the amount she is paid for each pair of curtains and each set of blinds.

(b) Curtains £ ____________________________

Blinds £ ____________________________ [3]
12 OACB is a parallelogram. 
\( \overrightarrow{OA} = a \) and \( \overrightarrow{OB} = b \). 
M is the midpoint of AB.

\[ \begin{align*} \end{align*} \]

(a) Find, in terms of \( a \) and \( b \), these vectors.

(i) \( \overrightarrow{OC} \)

(a)(i) ______________________ [1]

(ii) \( \overrightarrow{AB} \)

(ii) ______________________ [1]

(iii) \( \overrightarrow{OM} \)

(iii) ______________________ [2]

(b) Use your answers to write two conclusions about points O, M and C.

(1) ____________________________________________________________________________

(2) ____________________________________________________________________________ [2]

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13* Chord PQ is parallel to tangent TRU.

Calculate the size of angle $e$.
Give a geometrical reason for each stage of your working. [5]