ORDINARY LEVEL NATIONAL EXAMINATIONS, 2017

SUBJECT: MATHEMATICS I

DURATION: 3 HOURS

INSTRUCTIONS:

1) Write your name and index number on the answer booklet as they appear on your registration form, and DO NOT write your names and index number on additional answer sheets of paper if provided.
2) Do not open this paper until you are told to do so.
3) This paper has TWO sections: A and B.
   - SECTION A: Attempt ALL questions. (55 marks)
   - SECTION B: Attempt ONLY THREE questions. (45 marks)
4) You may use mathematical instruments and calculators where necessary.
5) Use a blue or black ink pen only to write your answers and a pencil to draw diagrams.
6) Show clearly all the working steps. Marks will not be awarded for the answer without all working steps.
SECTION A: ATTEMPT ALL QUESTIONS. (55 MARKS)

1) Solve the following equation: 3(x - 1) - (x + 9) = 0. (3 marks)

2) Find n given that: 45n = 41ten. (3 marks)

3) Solve for x: 2x^3 = 54. (3 marks)

4) Given that a = 3, b = -2 and c = 4, find the value of: ab^2 - bc + ac. (3 marks)

5) The interest on a loan is 24% per annum. How much is a loan that bears interest of 6,000 Frw after one year? (3 marks)

6) The area of a trapezium is 24cm^2. Its height is x and its parallel sides are (2x)cm and (x + 7)cm. Find the value of x. (4 marks)

7) A number (P) is increased by 80%. The new number is then increased by 60% giving a final result of 144. Find the original number (P). (4 marks)

8) In the figure below AB and AD are tangents to the circle. CD is a diameter and angle DAB = 40°. Find angle BCD. (4 marks)

9) It is given that g(x) = 3(x + 2) and f(x) = 3x + 2. Find gf(4). (4 marks)

10) If y is inversely proportional to x and y = 40 when x = 3, find y when x = 2.5. (4 marks)

11) The exterior angles of a pentagon measure respectively y°, 60°, 75°, y°, and 85°. Find the value of y°. (4 marks)

12) Solve the following simultaneous equations:
   \[8x + y = 21\]
   \[5x - 4y = -10\] (4 marks)

13) Find the equation of the line with gradient 5 and passing through the point (1, 9). (4 marks)
14) Solve the following inequality:
\[ \frac{1}{3}x - (x + 1) \geq 2. \]  
(4 marks)

15) In a class of 50 students, 40 like Mathematics (M) and 25 like Science (S). Some students (X) like both subjects and 2 do not like any of the two subjects. How many students like both Mathematics and Science?  
(4 marks)

SECTION B: ATTEMPT THREE QUESTIONS ONLY. (45 MARKS)

16) Factorize completely: \( P(x) = 6x^3 - 5x^2 - 12x - 4 \) and hence find the values of \( x \) when \( P(x) = 0. \)  
(15 marks)

17) The curved surface of a cylindrical tin is 628cm\(^2\) and its height is 10cm. \( \pi = 3.14. \) Find:
   (a) the radius of the circular base.  
   (b) the total surface area of the tin.  
   (c) the volume of the tin.  
   (d) the largest number of tins which will fill the box of length = 80cm, width = 60cm and height = 40cm.  
   (4 marks)
   (5 marks)
   (2 marks)
   (4 marks)

18) The following table gives the ages of 73 students and the frequency.

<table>
<thead>
<tr>
<th>Ages in years , ( x )</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency, ( f )</td>
<td>5</td>
<td>9</td>
<td>13</td>
<td>11</td>
<td>12</td>
<td>15</td>
<td>8</td>
</tr>
</tbody>
</table>

(a) Copy the table below and complete it.  
(9 marks)

<table>
<thead>
<tr>
<th>Age, ( x )</th>
<th>Frequency, ( f )</th>
<th>( fx )</th>
<th>Cumulative-frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
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<tr>
<td>20</td>
<td>( \Sigma f = )</td>
<td>( \Sigma fx = )</td>
<td></td>
</tr>
</tbody>
</table>

(b) Find the mode age.  
(c) Determine the median age.  
(d) Calculate the mean age.  
(1 mark)
(3 marks)
(2 marks)
19) (a) Use vectors \( \vec{a} = \begin{pmatrix} -5 \\ 12 \end{pmatrix} \), \( \vec{b} = \begin{pmatrix} 3 \\ 6 \end{pmatrix} \) and \( \vec{c} = \begin{pmatrix} -4 \\ -2 \end{pmatrix} \) to determine:

(i) \( \vec{a} + \vec{b} - \vec{c} \). \(2\) marks

(ii) the modulus of \( \vec{a} \). \(3\) marks

(b) \( K(4,7) \), \( L(2,3) \) and \( M(4,-1) \) are three vertices of a rhombus \( KLMN \).

(i) Use vectors to prove that triangle \( KLM \) is an isosceles triangle. \(3\) marks

(ii) Find the coordinates of \( N \). \(2\) marks

(c) Show that the points \( P(-3,-2) \), \( Q(3,1) \) and \( R(5,2) \) are collinear. \(3\) marks

(d) Vectors \( \vec{s} = \begin{pmatrix} 7 \\ 4 \end{pmatrix} \) and \( \vec{r} = \begin{pmatrix} 21 \\ r \end{pmatrix} \) are parallel.

Find the value of \( r \). \(2\) marks

20) The vertices of triangle \( STV \) are \( S(0,2) \), \( T(0,5) \) and \( V(0,3) \).

In the same Cartesian plane, draw:

(a) The triangle \( STV \). \(6\) marks

(b) (i) The triangle \( STV' \), image of triangle \( STV \) under reflection in \( y \)-axis. \(3\) marks

(ii) The triangle \( S''T''V'' \), image of triangle \( STV \) under a rotation about the origin through \(-90^\circ\). \(3\) marks

(iii) The triangle \( S'''T'''V''' \), image of triangle \( STV \) under translation, \( T = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \). \(3\) marks

(Use the graph in your answer booklet to answer this question).