INSTRUCTIONS TO CANDIDATES

1. Write your name school and index number in the spaces provided at the top of this space
2. The paper consists of two sections section I and section II
3. Answer all the questions in section I and only five questions from section II
4. All answers and working must be written on the question paper in the spaces provided below each question
5. Marks may be given for correct working even if the answer is wrong.
6. Negligence and slovenly work will be penalized
7. Non-programmable silent electronic calculators or a mathematical table may be used except where stated otherwise.

FOR EXAMINERS ONLY

SECTION 1

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SECTION II

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GRAND TOTAL
SECTION 1 (50 MARKS)

Answer all questions in the spaces provided

1. Using logarithms evaluate;

\[ \ln \left( \frac{7}{5} \right) \cdot \ln \left( \frac{5}{3} \right) \]

(4mks)

2. Make \( t \) the subject of formula.

\[ V = \frac{1}{3} - \frac{4}{1} \]

(3mks)

3. Evaluate;

\[ \int \left( 2 + 3 \right) \]

(3mks)

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4. Use matrix method to determine the co-ordinates of the point of intersection of the two lines.

\[3x - 2y = 13, \quad 2y + x + 1 = 0\]  

(3mks)

5. P and Q are the points on the ends of the diameter of the circle below.

a) Write down in terms of \(x\) and \(y\) the equation of the circle in the form;

\[ax^2 + by^2 + x + y + c = 0\]  

(2mks)

b) Find the equation of the tangent at Q in the form \(ax + by + c = 0\)  

(2mks)
6. Use binomial expansion to expand \((1 - \frac{1}{7})^4\) up to the 4th term \((2\text{mks})\)

7. Solve for \(x\)
\[
\log_8 x + \log_8 8 = \log_8 8\sqrt{2}
\]
\((3\text{mks})\)

8. An arc of a circle radius 3.5cm is 9.1cm long. Find the angle it subtends at the centre of the circle \((3\text{mks})\)
9. In the figure below ST and RU are parallel. Given that \( \angle RUT = \angle SRT \). \( RT = 12\text{cm} \), \( TS = 6\text{cm} \) and \( RS = 4.5\text{cm} \). calculate the length UT \( \text{UT} \) (3mks)

10. In Mr Mukala’s shop, a radio has marked price of ksh10000. Mr mukala can allow a reduction of 15% on the marked price and still make a profit of 25% on the cost price of the radio. What was the cost price of the radio \( \text{Cost Price} \) (3mks)

11. A point \( T \) divides a line \( AB \) internally in the ratio 5:2. Given that \( A \) is (4,10) and \( B(11,3) \). Find the coordinates of \( T \) \( T \) (4mks)
12. Grade x and grade y sugar cost sh60 and sh50 per kilogram respectively. In what proportion must the two grades be mixed to produce a blend that cost sh53 per kilogram (3mks)

13. Use the identity \( \sin^2 \theta + \cos^2 \theta = 1 \) to find the values of \( \sin \theta \), Given that \( \cos \theta = \frac{4}{5} \) (3mks)

14. A two-digit number is made by combining any of the two digits 1, 3, 5, 7 and 9 at random.

   a) Make an array of possible combinations (2mks)

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   b) Find the probability that the number formed is prime (1mk)
15. Simplify completely
\[ \frac{\sqrt{\frac{x}{y}}}{z} \] (3mks)

16. Mukai travels from A to B at \(x\)km/h. The two towns are 40km apart. She then travels to town C at \((x + 6)\)km/h. Town B and C are 100km apart. If the time she takes from B to C is the same time from A to B, find the value of x (3mks)
17. Income tax is charged on annual income at the rate shown below

<table>
<thead>
<tr>
<th>Taxable income (K£)</th>
<th>Rate (sh per K£)</th>
</tr>
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<tbody>
<tr>
<td>1 – 1500</td>
<td>2</td>
</tr>
<tr>
<td>1501 – 3000</td>
<td>3</td>
</tr>
<tr>
<td>3001 – 4500</td>
<td>5</td>
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<tr>
<td>4501 – 6000</td>
<td>7</td>
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<tr>
<td>6001 – 7500</td>
<td>9</td>
</tr>
<tr>
<td>7501 – 9000</td>
<td>10</td>
</tr>
<tr>
<td>9001 – 12000</td>
<td>12</td>
</tr>
<tr>
<td>Over 12000</td>
<td>13</td>
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</tbody>
</table>

a) A certain headmaster earns a monthly salary of Ksh8570. He is housed in the school and as a result his taxable income is 15% more than his salary. He is entitled to a family tax relief of ksh150 per month. How much tax does he pay in a year (6mks)
b) From the headmasters salary the following deductions are also made every month

- WC PS: 2% of gross salary
- NHIF: ksh20
- House rent, water and furniture charges: ksh 246

Calculate the headmaster’s net salary for each month (4mks)

18. The figure below is a solid in which base ABCD is a rhombus. AC = 16km, BD = 12cm and CE = 12cm. Calculate the angle between the planes

a) EBD and ABCD (4mks)
b) ECB and EBD (3mks)

c) Length BC and BE (3mks)

19. a) Fill the table below

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
<th>75</th>
<th>90</th>
<th>120</th>
<th>150</th>
<th>180</th>
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<tbody>
<tr>
<td>3Sin x -1</td>
<td>-1</td>
<td>0.5</td>
<td>1.6</td>
<td>2</td>
<td></td>
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<tr>
<td>Cos x</td>
<td>1</td>
<td>0.87</td>
<td>0.71</td>
<td>0.5</td>
<td>0</td>
<td>-0.5</td>
<td>-0.87</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2mks)

b) Using the same axis draw on the graph paper provided, the graph of \( y = 3 \sin x - 1 \) and \( y = \cos x \) for \( 0^\circ \leq x \leq 180^\circ \) (5mks)

c) Use your graph to solve the equation

i) \( 3 \sin x - \cos x = 1 \) (1mk)

ii) \( 3 \sin x = 1 \) (2mks)

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20. A bag contains 3 red, 4 white and 5 green balls. Three balls are selected without replacement. Find
the probability that the three balls chosen are

a) All Red

b) All green

c) One of each colour

(2mks)  (2mks)  (6mks)
21. A particle moving along a straight line covers a distance 5 metres in time t seconds from a fixed point O on the line where \( s = t^3 - 6t^2 + 8t - 4 \)

Find

a) The velocity of the particle when \( t = 5 \)  
(3mks)

b) The acceleration when \( t = 5 \) seconds  
(3mks)

c) The time when the velocity of the particle is constant  
(4mks)
22. a) Using a rular and a pair of compass only construct triangle ABC in which \(<BAC = 120^\circ AB = 6.4\text{cm and } AC = 7.0\text{cm} \) (4mks)

Measure i) \(<ABC \) (1mk)

ii) BC (1mk)

b) Construct the circumscribed circle of triangle ABC withO as its centre. Describe the circumscribed circle as a locus (4mks)
23. Two aircrafts A and B took off at the same time on Monday from Jomo Kenyatta International Airport (1°S, 37°E) at 11.00Pm. Aircraft A flew due East and Aircraft B flew due west. If they met again after 18 hours at (1°S, 117°W), calculate: (take radius of Earth = 6370km)

i) Their respective speeds in km/h (to 2d.p) (8mks)

24. The time they met again (2mks)
25. A ball is kicked vertically upwards from a point 0.5m above the ground at a velocity of 16m/s. Assuming that acceleration due to gravity is 10m/s²

Determine

a) An expression for its velocity t seconds later

b) An expression for its height above the ground t seconds later

c) The maximum height reached by the ball