**NAME ADMNO CLASS**

**MATHEMATICS Paper 2 2½ Hours 121/1**

MECS CLUSTER JOINT EXAMINATION

***FORM FOUR END OF THE TERM TWO EXAMINATION 2021***

 **MATHEMATICS**

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, index number and class in the spaces provided above.
2. The paper contains two sections: **Section I** and **Section II**.
3. Answer **ALL** the questions in **Section I** and **ANY FIVE** questions from **Section II**.
4. All working and answers must be written on the question paper in the spaces provided below each question.
5. Marks may be awarded for correct working even if the answer is wrong.
6. Negligent and slovenly work will be penalized.
7. Non-programmable silent electronic calculators and mathematical tables are allowed for use.

**SECTION I (50 MARKS)**

***Answer ALL the questions in this section.***

1. Use logarithms to evaluate:

$\sqrt[3]{\frac{45.3 ×0.00697}{0.534}}$ (4 marks)

1. a) Expand $\left(1- \frac{1}{2}x\right)^{6}$up to fourth term. (2 marks)

 b) Use the expansion above to evaluate (0.98)6 (2 marks)

1. The data below represents the ages in months at which 11 babies started walking:

9,15 , 12, 9, 8, 13, 7, 11, 13, 14 and 10.

Calculate the interquartile range of the above data (3 marks)

1. The fifth term of an arithmetic progression is 11 and the twenty fifth term is 51.

Calculate the first term and the common difference of the progression. (3 marks)

1. If $\frac{\sqrt{3}-2\sqrt{2}}{3\sqrt{2}+\sqrt{3}}=a\sqrt{b}+c$ Find the values of a, b and c. (3 marks)
2. In the figure below QT is a tangent to the circle at Q. PXRT and QXS are straight lines.

PX = 6cm, RT = 8cm, QX = 4.8cm and XS = 5cm.



 Find the length of QT (3 marks)

1. Solve for x in the equation below:

 Log 3(x + 3) = 3 log 3 + 2 (3 marks)

1. Pipe A can fill a tank in 2 hours, Pipe B and C can empty the tank in 5 hours and 6 hours respectively. How long would it take:
2. To fill the tank if A and B are left open and C is closed. (2 marks)
3. To fill the tank with all pipes open. (2 marks)
4. A transformation is represented by the matrix$ \left[\begin{matrix}1&3\\4&2\end{matrix}\right]$ . This transformation maps a triangle ABC of the area 12.5cm2 onto another triangle A′B′C′. Find the area of triangle A′B′C′.

(3marks)

1. Make P the subject of the formula XYP = QPX (3 marks)
2. The coordinates of the end points of diameter are A(2,4) B(−2,6). Find the equation of a circle in the form ax2 + by2 +cx + dy + e = 0 (3 marks)
3. A bag contains 10 balls of which 3 are red, 5 are white and 2 green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and a ball picked at random. Find the probability the ball so chosen is red. (3 marks)
4. Use the trapezium rule with seven ordinates to find the area bounded by the curve $y= x^{2}+1$ lines x = -2, x = 4 and x – axis (3 marks)
5. Wanjiku pays for a car on hire purchase in 15 monthly instalments. The cash price of the car is Ksh.300, 000 and the interest rate is 15%p.a. A deposit of Ksh.75, 000 is made. Calculate her monthly repayments. (3 marks)
6. The length and breadth of a rectangular floor garden were measured and found to be 4.1m and 2.2m respectively. Find the percentage error in its area. (3 marks)
7. The gradient function of a curve is given $\frac{dy}{dx}$ = 3x2 – 8x + 2. If the curve passes through the point, (2, –2), find its equation. (3 marks)

**SECTION II (50 MARKS)**

***Answer five questions only from this section***

1. The following table shows the rate at which income tax was charged during a certain year.

|  |  |
| --- | --- |
|    Monthly taxable income in Ksh. | Tax rate % |
| 0 - 9860 | 10 |
| 9861 - 19720 | 15 |
| 19721 - 29580 | 20 |
| 29581 - 39440 | 25 |
| 39441 - 49300 | 30 |
| 49301 - 59160 | 35 |
| over 59160 | 40 |

A civil servant earns a basic salary of Ksh.35750 and a monthly house allowance of sh.12500. The civil servant is entitled to a personal relief of sh.1062 per month. Calculate:

  **a)** Taxable income (2 marks)

 **b)** Calculate his net monthly tax (5 marks)

 **c)** Apart from the salary the following deduction are also made from his monthly income.

  WCPS at 2% of the basic salary

 Loan repayment Ksh.1325

 NHIF sh.480

  Calculate his net monthly earning. (3 marks)

1. a) Complete the table below for y=sin 2x and y=sin ( 2x + 30) giving values to 2d.p

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X | 0 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 |
| Sin 2x | 0 |  |  |  | 0.87 |  |  |  | -0.87 |  |  |  | 0 |
| Sin ( 2x + 30) | 0.5 |  |  |  | 0.5 |  |  |  | -1 |  |  |  | 0.5 |

 (2 marks)

 b) Draw the graphs of y=sin 2x and y = sin (2x + 30) on the axis. (4 marks)



c) Use the graph to solve  (1 mark)

d) Determine the transformation which maps  (1 mark)

e) State the period and amplitude of  (2 marks)

1. A plane S flies from a point P (400N, 450W) to a point Q (350N, 450W) and then to another point T (350N, 1350E).
2. Given that the radius of the earth is 6370km find the distance from P to Q in Km.

(Take = $\frac{22}{7}$) (2 marks)

1. Find in nm
2. The shortest distance between Q and T. (2 marks)
3. The longest distance between Q and T (to the nearest tens) (2 marks)
4. Find the difference in time taken when S flies along the shortest and longest routes if its speed is 420 knots (4 marks)
5. The following table shows the distribution of marks obtained by 50 students.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Marks | 45 – 49 | 50 – 54 | 55 – 59 | 60 – 64 | 65 – 69 | 70 – 74 | 75 – 79 |
| No. of students | 3 | 9 | 13 | 15 | 5 | 4 | 1 |

 By using an assumed mean of 62, calculate

1. the mean (5 marks)
2. the variance (3 marks)
3. the standard deviation (2 marks)`
4. The diagram below represents a pyramid standing on rectangular base ABCO. V is the vertex of the pyramid and $VA = VB = VC = VD = 26 cm$. M is the midpoints of BC and AC respectively. $AB = 24 cm$ and $BC = 18 cm$.



 Calculate:-

1. The length of the projection of line VA on plane ABCD (2marks)
2. The angle between line VA and the plane ABCD. (2marks)
3. The size of the angle between the planes VBC and ABCD. (2marks)
4. The vertical height of the pyramid. (2marks)
5. The volume of the pyramid (2marks)
6. A parallelogram OACB is such that **OA** = **a**, **OB** = **b.** D is the mid-point of BC. **OE** = h**OC** and **AE** = k**AD**.



1. Express the following in terms of **a**, **b**, h and k.
2. **OC** (1 mark)
3. **OE** (1 mark)
4. **AD** (1 mark)
5. **AE** (1 mark)
6. Find the values of h and k. (4 marks)
7. Determine the ratios:
8. AE : ED (1 mark)
9. OE : OC (1 mark)
10. A uniform distributor is required to supply two sizes of skirts to a school: medium and large sizes. She was given the following conditions by the school.
11. The total number of skirts must not exceed 600.
12. The number of medium size skirts must be more than the number of large size skirts.
13. The number of medium size skirts must not be more than 350 and the number of large size skirts must not be less than 150. If the distributor supplied χ medium size and y large size skirts.
14. Write down, in terms of χ and y, all the linear inequalities representing the conditions

above. (4mks)

(b) On the grid provided, represent the inequalities in (a) above by shading the unwanted

regions. (4mks)



The distributor made the following profits per skirt.: Medium size = Sh.300., Large size = Sh.250. Determine the maximum profit. (3mks)

1. (a) On the same diagram construct:-
2. Triangle PQR such that PQ = 9cm, PR = 7cm and triangle RPQ = 600 (2 marks)
3. The locus of a point M such that M is equidistant from P and Q. (1mark)
4. The locus of a point N such that RN ≤ 3.5cm. (1 mark)

 b) On the diagram in part (a)

1. Shade the region B, containing all the points enclosed by the locus on M and the locus of N such that PM ≥ QM. (2marks)
2. Find the area of the shaded region in (i) above (4marks)