**Name………………………………………………………. Index No…………………**

**School…………………………………………………… Date ………………………**

**Candidate’s Signature………………………**

**121 /2**

**MATHEMATICS**

**PAPER 2**

**JUNE 2022**

**2 ½ HRS**

**MOMALICHE JOINT EXAM**

***Kenya Certificate of Secondary Education (K.C.S.E)***

## INSTRUCTIONS TO CANDIDATES

(a) Write your name and index number in the spaces provided above.

(b) This paper consists of **TWO** sections. Section I and Section **II**.

(c) Answer **ALL** the questions in section 1 and only **FIVE** questions from Section **II**

(d) All answers and working must be written on the question paper in the spaces provided below each question.

(e) Show all the steps in your calculations, giving your answers at each stage in the spaces below

 each question.

(f) Marks may be given for correct working even if the answer is wrong.

(g) Non- programmable silent calculators and **KNEC** mathematical tables may be used except where stated otherwise.

 (h) Candidates should check the question paper to ascertain that all the papers are printed as indicated and that no questions are missing.

**FOR EXAMINERS USE ONLY**

**SECTION I**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Section II**

**GRAND TOTAL**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | TOTAL |
|   |  |  |  |  |  |  |  |  |

1. Solve the quadratic equation by completing the square method.

x2 – 7x + 10 = 0 (3mks)

1. Simplify $\frac{\sqrt{5}- \sqrt{3}}{\sqrt{5+ \sqrt{3}}}$ by rationalizing the denominator. (2mks)
2. Grade x rice costs shs 75 per kg and grade y rice costs shs 50 per kg. The two grades are mixed in the ratio such that the blend costs sh 70 per kg. Find the ratio in which grade x rice was mixed with grade y rice. (3mks)
3. Given that A = $\sqrt[4]{\frac{d-c^{2}g}{b+c^{2}f}}$ make c the subject of the formula. (3mks)
4. Solve the equation 2 sin (3x + 60) = 1 for 00 ≤ x ≤ 1800 (3mks)
5. (a) Expand and simplify (2 – x) 8 up to 4th term. (2mks)

(b) Use the simplified expression in (a) above to estimate the value of (1.99)8 giving your answer correct to 4 significant figures. (2mks)

1. Solve the equation 2+ log3 (2x -7) = log3 (5x - 7) . (3mks)
2. (a) Construct a triangle ABC in which AB is 2.2cm, BC is 3.5cm and angle ABC

 is 600 (2mks)

(b) A point D moves such that it is on the same side of BC as A. Construct the locus of D such that the area of ΔABC = area of ΔBCD. (2mks)

1. The equation of a circle is x2 + y2 – 6x + 8y – 11 = 0. Find the coordinates of the centre of the circle and its radius. (3mks)
2. The length of a rectangle is 8.3 cm and its width is 5.45cm. Calculate
3. The relative error in area of the rectangle (3mks)
4. The percentage error in area (1mk)
5. A triangle xyz whose area is 15.3cm2 mapped onto Δx1y1z1 by a transformation whose matrix is m =$\left(\begin{matrix}3&-2\\-1&2\end{matrix}\right)$. Find the area of Δx1y1z1. (3mks)
6. Solve the triangle (3mks)

 P

 10.8cm

 9.4cm

 Q R

1. Fifteen men working at the rate of 9 hours per day take 20 days to complete a job. Find the number of days 27 men would take to complete the same job working at the rate of 10 hours a day. (3mks)
2. The 5th term of an arithmetic sequences is 71 and the 7th term is 59. Find
3. The first term and the common difference. (2mks)
4. The 10th term (2mks)
5. Use matrix methods to solve the simultaneous equations. (3mks)

3x – 4y = 2

6x + y = 13

1. Factorise: 2x2 – x – 10

 (2mks)

**SECTION (II) (50MARKS)**

1. The following table shows the distribution of marks obtained by 50 students of a certain school.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

1. State the modal class (1mk)
2. By using an assumed mean of 62, calculate
3. The mean (5mks)
4. The standard deviation (4mks)
5. The figure below is a triangle OAB, where OA = a and OB = b. A point R divides AB in the ratio 2:5 and a point T divides OB in the ratio 1:3. OR and AT intersect at D.

 R B

 A

 O

1. Find in terms of a and b
2. BT (1mk)
3. OR (2mks)
4. AT (1mk)
5. Given that AD = KAT and RD = hRO where k and h are scalars. Find the values of k and h, hence express AD in terms of a and b (5mks)
6. John travels to work by either boda-boda or by tuk-tuk. If he travel by tuk-tuk on every one day, there is a probability of 0.75 that he travels by a boda boda the following day. If he travels by a boda boda on any one day, then he travels by tuk-tuk the following day with a likelihood of $\frac{5}{6}$ . There is a chance of $\frac{2}{3}$ that he travels by tuk-tuk on Tuesday.
7. Draw a tree diagram to illustrate the possible outcomes in 3 days. (2mks)
8. Find the probability that he travel by;
9. Boda-boda on Wednesday (2mks)
10. Tuk-tuk on Wednesday (2mks)
11. Boda – boda on Thursday (3mks)
12. Tuk-tuk on Thursday (1mk)
13. (a) Fill the table below for the curves given by y = 3sin(2x + 300) and y = cos2x for x value in the range 00≤ x ≤ 1800 (2mks)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x | 00 | 150 | 300 | 450 | 600 | 750 | 900 | 1050 | 1200 | 1350 | 1500 | 1650 | 1800 |
| Y = 3 sin (2x + 30)  | 1.50 |  |  | 2.60 |  |  |  |  |  | -2.60 |  |  | 1.50 |
| Y =cos 2x  | 1.00 |  |  |  |  | -0.87 |  |  | -0.50 |  |  |  | 1.00 |

b) Draw the graph of y = 3 sin (2x + 300) Y = 3sin (2x + 300) and y = cos 2x on the same axes. (4mks)

x-axis 1cm rep 150

y-axis 1cm rep 0.5 units

(c) Use your graph to solve the equation 3sin (2x +300) = cos 2x (2mks)

(d) Determine the following from your graph

1. Amplitude of $y=3sin\left(2x+30^{0}\right)$ (1mk)
2. The period of $y=3sin\left(2x+30^{0}\right)$ (1mk)
3. An arithmetic progression has the first term as *a* and the common difference as *d*.
4. Write down in terms of *a* and *d* the 3rd, 9th and 25th term of the progression (1mk)
5. The progression is increasing, and the 3rd, 9th and 25th terms form the first three consecutive terms of a geometric series. If the sum of the 7th and twice the 6th term of arithmetic progression is 78, calculate
6. The first term and the common difference of the AP. (6mks)
7. The sum of the first nine terms of the AP. (3mks)
8. The figure below is a right rectangular based pyramid VABCD where AB =5cm,

BC =7cm and VC =VB=VA=VD=13cm and O is a point on the base of the pyramid vertically below V.

Calculate

1. The length of AC (2mks)
2. VO the height of the pyramid. (2mks)
3. The angle between the edge VB and the plane ABCD (3mks)
4. The angle between the planes VBC and ABCD (3mks)
5. Three quantities L, M and N are such that L varies directly as M and inversely as the square root of N.
6. Given that L = 2250 when M = 450 and N = 64, write down an equation connecting L, M and N. (4mks)
7. If M decreased by 16% and N increased by 44%, calculate the percentage change in L. (3mks)
8. In soccer competition, the number of goals (G) scored in a penalty shoot-out is partly constant and partly varies as the skill (S) of the player. Given that G = 8 when S = 2 and G = 12 when S =4, find the value of G when S = 6. (3mks)
9. The table below shows income tax rates

|  |  |
| --- | --- |
| Monthly taxable pay (k£) | Rate of tax ksh per £ |
| 1- 435436 – 870871 – 13051306 – 1740Excess over 1740 | 23456 |

A company employee earns a monthly basic salary of Ksh 28,000. He is also entitled to the following monthly allowances: house allowance of Ksh 9000, a medical allowance of sh 2000 and a commuter allowance of shs 1480.

1. Calculate his total income tax. (5mks)
2. He is entitled to a personal tax relief of Ksh 1056 per month. Determine the net tax. (1mk)
3. If he received a 50% increase in his total income, calculate the corresponding percentage increase on the income tax. (4mks)