**NAME** ……………………………………….…… **ADM NO**……….… **DATE** …….………

**SCHOOL**…………………………………………...……… **SIGNATURE** …………...……….

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MATHEMATICS

FORM 4 PAPER 2

SEPTEMBER 2022

TIME: 2 ½ HOURS

**OPENER EXAMINATION TERM 3, 2022**

**Kenya Certificate of Secondary Education 2022**

**INSTRUCTIONS TO CANDIDATES**

1. *Write your name and admission number in the spaces provided at the top of this page.*
2. *This paper consists of two sections:* **Section I and Section II.**
3. *Answer* ***al****l questions in* **section I** and any five questions in Section **II.**
4. *Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.*
5. *Marks may be given for correct working even if the answer is wrong.*
6. ***KNEC*** *Mathematical tables may be used.*

**For Examiner’s Use Only**

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

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| **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** |
|  |  |  |  |  |  |  |  |

 **Grand**

 **Total**

1. Paint *x* cost Ksh 50 per litre while paint *y* cost Ksh 70 per litre. In what proportion must x be mixed with y to produce a mixture costing Ksh 58 per litre? (3 marks)

1. The first, third and seventh terms of an increasing arithmetic progression are the three consecutive terms of a G.P. If the first term of the A.P is 10, find the common difference of the AP. (3 marks)
2. Given that the expression is a perfect square, find the value of *k*. (2 marks)
3. Make *y* the subject of the formula. (3 marks)
4. Four quantities are such that P varies directly as the square of R and square root of Q and inversely as the fourth root of M. Given that P = 300 when R =2, Q = 9 and M = 16, find the value of Q when P = 2500, R = 5 and M = 81. (4 marks)
5. Construct rectangle ABCD in which AB = 4 cm and BC = 3 cm. Inside the rectangle, construct the locus of point;
6. which is 2 cm from A. (2 marks)
7. which is equidistant from the line AB and AD. (1 mark)
8. which is 2 cm from the line AB. (1 mark)
9. The figure below shows a right pyramid VABCD with a square base of side 6cm.

 VA =VB = VC = VD = 12cm



 Calculate the height of the pyramid correct to 2 d.p (3 marks)

1. (a) Expand and simplify up to the term with . (1 mark)

(b) Use the expansion in (a) above to estimate the value of (2 marks)

1. A plot of land was valued at Sh. 500 000 at the start of 2004. It appreciated by 20% during the year 2004. Thereafter every year it appreciated by 10% of its previous year’s value. Find.
2. The value of the land at the start of 2005. (2 marks)
3. The value of the land at the end of 2007. (2 marks)
4. Solve the equation:

 for  (2 marks)

1. The time in New York is 1200h while the local time in Rome is 1744h. Find the distance between the two towns in kilometres if they lie on the parallel of latitude. Take the radius of the earth to be 6370 km and . (3 marks)
2. A bag contains blue green and red pens of the same type in the ration 8:2:5 respectively. A pen is picked at random without replacement and its colour noted. Determine the probability that the first pen picked is
3. Blue (1 mark)
4. Either green or red. (2 marks)
5. A point P has the coordinates if , find:-
6. The coordinates of point Q (2 marks)
7. The modulus of PQ (1 mark)
8. Triangle PQR is mapped onto triangle by a transformation whose matrix is . If the area of the triangle is 40 sq. units, find the area of the triangle PQR. (3 marks)
9. The table below shows values of the function

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 3 |  | 4 | 5.25 | 7 |  | 12 | 15.25 | 19 |  | 28 |  | 39 |

1. Complete the table. (1 mark)
2. Use the mid ordinate rule with six ordinates to estimate the area bounded by , the axis, the axis and the line . (2 marks)
3. Solve for x in the equation

 (4 marks)

**SECTION II 50 Marks**

**Answer any five questions ONLY in this section.**

1. In the figure below, EF is diameter of the circle BEGFH centre A. CBD is a tangent to the circle at B, BH = FH and angle BFE



Giving reasons determine the following angles

1. Angle EBC (2 marks)
2. Angle EGF (2 marks)
3. Angle FBH (2 marks)
4. Angle HEB (2 marks)
5. Angle HAF (2 marks)
6. John bought 3 brands of tea A, B and C. The cost price of the three brands were Sh. 25, Sh. 30 and Sh. 45 per kilogram respectively. He mixed the three brands in the ratio 5:2:1 respectively. After selling the mixture, he made a profit of 20%.
7. How much profit did he make per kilogram of the mixture? (3 marks)
8. After one year the cost price of each brand was increased by 12%.
9. How much did he sell one kilogram of the mixture to make a profit of 20%? Give your answer to the nearest 5 cents. (4 marks)
10. What would have been the percentage profit if he sold one kilogram of the mixture as Sh. 40.25. (3 marks)
11. Mr. Njagi, a civil servant earns a basic salary of Sh 38,300 house allowance of Sh 12,000 and medical allowance of Sh. 3600 every month. He claims a family relief of Sh 1172 and insurance relief of 3% of the premiums paid. Using tax table below

|  |  |
| --- | --- |
| Taxable income (£) p.a | Tax Ksh/£ |
| 1 - 8800 | 2 |
| 8801 -16800 | 3 |
| 16801 - 24800 | 5 |
| 24801 - 36800 | 7 |
| 36801 - 48800 | 9 |
| Over 48800 | 10 |

1. Calculate Mr. Njagi’s annual taxable income in Kenya pounds per annum (2 marks)
2. Tax due every month from Mr. Njagi to 2 decimal places (5 marks)
3. If further deductions are made every month from his salary
* WCPS of 2 % of basic salary
* Life insurance premium of Sh. 4600
* Sacco loan repayment Sh. 14200

 Calculate

1. Total deductions (1 mark)
2. His net pay per month (2 marks)
3. A successive transformation is represented by **LUV** and it maps an object ABC whose coordinates are A (2, 1) B (4, 1) and C (3, 4) onto its successive images.
4. On the grid provided, draw the object. (1 mark)
5. Determine the coordinates of the successive images hence plot them on the same axes provided above given that , and (6 marks)
6. Determine a single matrix that maps the object onto the final image. (2 marks)
7. Calculate the area of the object ABC. (1 mark)
8. The table below shows the marks scored by 40 form 4 students in a mathematics test.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Marks  |  |  |  |  |  |  |  |  |  |
| Frequency | 2 | 4 | 5 | 7 | 10 | 6 | 3 | 2 | 1 |

1. Using an assumed mean score of 55, calculate the mean of the data. (3 marks)
2. Calculate the lower quartile. (2 marks)
3. On the grid provided draw the cumulative frequency curve to represent the above distribution. (3 marks)
4. From the graph estimate;
5. The 5th decile. (1 mark)
6. Range of marks of the middle 80% of the students. (1 mark)
7. (a) Complete the table below, leaving all your values correct to 2 d.p. for the functions

 and (2 marks)

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

1. For the function

State:

1. The period (1 mark)
2. Phase angle (1 mark)
3. On the same axes draw the waves of the functions and for . Use the scale 1cm rep 300 horizontally and 2 cm rep 1 unit vertically. (4 marks)
4. Use your graph above to solve the inequality (2 marks)
5. The velocity V metres per second of a particle projected into space is given by the formula , where t is time in seconds. Determine;
6. Acceleration of the particle when t = 2 seconds. (3 marks)
7. The value of t when acceleration is minimum. (2 marks)
8. The velocity when the acceleration is minimum. (2 marks)
9. The distance covered between the 1st and 2nd seconds. (3 marks)

1. (a) Complete the tale below for the equation (2 marks)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | 32 |  | 8 |  | 0 | 2 | 8 | 18 |
|  |  |  |  |  | 0 |  | 6 | 9 |
|  |  |  |  |  |  |  |  |  |
|  | 9 |  |  |  |  |  |  | 16 |

(b) On the grid provided, draw the graph of . (3 marks)

(c) On the same axes draw the graph of (2 marks)

(d) Use your graph to solve the quadratic equations;

1. (1 mark)
2. (1 mark)
3. (1 mark)