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

**SCHOOL** …………………………………………………………… **DATE** ……………………

 **CANDIDATE’S SIGNATURE** …………………..

**FORM 3**

**MATHEMATICS**

**DEC 2021 TIME:**

**END OF TERM TWO 2021 EXAMINATIONS**

**Kenya Certificate of Secondary Education**

**MATHEMATICS**

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, admission number and school in the spaces provided.
2. This paper consists of two sections; **Section I** and **Section II.**
3. Answer ALL the questions in Section I and ONLY FIVE questions in Section II.
4. All answers and working must be written on the question paper in the spaces provided below each question.
5. Show all the steps in your calculations, giving your answer at each stage in the space provided below each question.
6. Marks may be given for correct working even if the answer is wrong.
7. Non programmable silent electronic calculators and **KNEC** mathematical tables may be used except where stated otherwise.
8. Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

FOR EXAMINERS USE ONLY

SECTION I

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

SECTION II

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Question** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **TOTAL** |
| **Marks** |  |  |  |  |  |  |  |  |  |

 **Grand Total**

**SECTION I (50 Marks)**

**Answer all the questions in the spaces provided.**

1. Without using tables or a calculator evaluate; (3 marks)
2. Factorize completely (2 marks)
3. A Kenyan bank buys and sells foreign currencies as shown below.

|  |  |  |
| --- | --- | --- |
| **Currency**  | **Buying (Ksh)** | **Selling (Ksh)** |
| 1 Hong Kong dollar | 9.84 | 9.87 |
| 100 Japanese yen  | 76.08 | 76.12 |

A tourist arrived in Kenya with 100 500 Hong Kong Dollars and changed the whole amount to Kenyan shillings. While in Kenya he spent Ksh. 430 897 and changed the balance to Japanese yen before leaving for Tokyo. Calculate the amount in Japanese Yen that he received. (3 marks)

1. Use logarithm tables to evaluate (4 marks)
2. The sides of a triangle were measured to 1 decimal as 6.5cm, 7.4cm and 8.2cm respectively. Calculate the percentage error in its perimeter (4 marks)
3. Line passes through points and . Find the equation of the line , the perpendicular bisector of AB leaving your answer in the form . (3 marks)
4. In the figure below, O is the centre of the circle. AC = 6 cm, BC = 9 cm and



1. Calculate length AB correct to 2 decimal places. (2 marks)
2. Calculate the area of the circle. (2 marks)
3. Evalute, without using mathematical tables or the calculator, the expression. (3 marks)

1. Rationalize the denominator and leave your answer in surd form. (3 marks)
2. Solve the quadratic equation using completing the square method. (3 marks)
3. The hire purchase terms of a cupboard is a deposit of Ksh 4,400 and six monthly installments of Ksh 900 each. The hire purchase price is 175% of the cost price while the cash price is 25% more than the cost price .Calculate the cash price of the cupboard. (3 marks)
4. Construct triangle PQR in which and . Measure PR. (3 marks)
5. **A** and **B** are two matrices. If find B given that **.** (3 marks)
6. Make the subject of the formulae in (3 marks)
7. Solve the following inequality and show your solution on a number line. (3 marks)
8. The sixth term of an arithmetic progression is 27 and the tenth term is 43. Find the 16th term. (3 marks)

**SECTION II (50 Marks)**

**Answer ONLY five the questions in the spaces provided.**

1. Mr. Omwega is employed. His basic salary is Kshs. 21, 750 and is entitled to a house allowance of Kshs 15, 000 and a travelling allowance of Kshs 8, 000 per month. He also claims a family monthly relief of Kshs 1, 056 per month. Other deductions are;

 Union dues Kshs 200 and

 Co-operative shares Kshs 4, 500 per month.

The table below shows the tax rates for the year.

|  |  |
| --- | --- |
| **Income (Kshs per annum)** | **Tax rates** |
| 1 – 116, 600116, 161 – 225, 600225, 601 – 335, 040335, 041 – 444, 480Over 444, 480 | 10%15%20%25%30% |

 Calculate;

1. Mr. Omwega’s annual taxable income. (2 marks)
2. The tax paid by Mr. Omwega in the year. (6 marks)
3. Mr. Omwega’s net income per month. (2 marks)
4. a) Complete the table below giving your values correct to 2 decimal places. (2 marks)

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

1. On the grid provided, draw on the same axes the graph of and for interval . Take the scale 1 cm represent on axis and 2 cm represent 1 unit on the – axis. (4 marks)
2. Use the graph in (b) above to solve the equation;
3. (2 marks)
4. (2 marks)
5. Triangle ABC has coordinates and .
6. On the grid provided, draw triangle ABC. (1 mark)
7. Triangle is the image of triangle ABC under an enlargement with scale factor about the origin. On the same grid draw triangle and state its coordinates. (3 marks)
8. Triangle is the image of triangle under a rotation of about the origin. On the same grid draw triangle and state its coordinates. (3 marks)
9. Under a certain translation T, the image of points are mapped onto triangle such that point is mapped onto
10. Find the translation T. (1 mark)
11. Find the coordinates of the image points and and plot triangle on the same grid. (2 marks)
12. A parent has two children whose age difference is 5 years. Twice the sum of the ages of the two children is equal to the age of the parent.
13. Taking to be the age of the elder child, write an expression for
14. The age of the younger child. (1 mark)
15. The age of the parent (1 mark)
16. In twenty years’ time, the product of the children’s age will be 15 times the age of their parent
17. Form an equation in and hence determine the present possible ages of the older child. (4 marks)
18. Find the present possible ages of the parent. (2 marks)
19. Determine the possible ages of the younger child in twenty years’ time. (2 marks)
20. The masses of 40 students were measured to the nearest kilogram and recorded as shown below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 52 | 58 | 54 | 51 | 59 | 53 | 56 | 51 |
| 43 | 41 | 53 | 58 | 54 | 65 | 58 | 59 |
| 49 | 63 | 49 | 49 | 47 | 45 | 46 | 52 |
| 52 | 55 | 52 | 55 | 49 | 57 | 53 | 63 |
| 42 | 45 | 46 | 48 | 60 | 49 | 48 | 53 |

1. Use this data to complete the table below. (4 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Mass in Kg | Class mid point  | Frequency |  |
|  |  |  |  |
|  | 48 | 10 | 480 |
|  |  |  |  |
|  |  |  |  |
|  | 63 | 3 | 189 |
|  | ∑f = 40 | ∑f  |

1. Calculate ;
2. The mean mass. (2 marks)
3. The median mass (2 marks)
4. Draw a frequency polygon for the distribution. (2 marks)
5. The figure below shows two pulleys with centres A and B of radii 9 cm and 6 cm respectively. C and D are contact points of the belt with the pulleys. The distance between the centres of the two pulleys is 50 cm. a belt is tied around the two pulleys as shown.



Calculate,

1. Length DC (2 marks)
2. The length of arc DE (3 marks)
3. The length of arc CF (3 marks)
4. The total length of the belt. (2 marks)
5. The figure below shows a rectangle attached to a semi-circle



1. Calculate;
2. the area of the figure (3marks)
3. the perimeter of the figure (3 marks)
4. If the figure represents a cross-section of a steel girder of length 9m, determine the volume of the steel girder in cubic centimetres (2 marks)
5. If the mass of the steel girder is 306kg, calculate its density in g/cm3. (2 marks)
6. Five towns P,Q, R S and T are situated such that Q is 200 km east of P. R is 300 km from Q on a bearing of from Q. S is 350 km on a bearing of from R. T is 250 km from S and its bearing from P is .
7. Using a scale of 1 cm to represent 50 km, draw a diagram representing the position of the towns. (5 marks)
8. From the diagram, determine:
9. The distance in km from P to T. (1 mark)
10. The bearing of S from Q. (1 mark)
11. A plane heading to town R takes off from town P and flies upward at a constant angle which is less than . After flying a distance of 100 km in the air, it sees a town R at angle of depression of . By scale drawing, find the horizontal distance of the plane from R at this point. (3 marks)