**END TERM 1-2023**

**MATHEMATICS PAPER 2 (121/2)**

**FORM FOUR**

**TIME: 2 ½ HOURS**

**Name**: …………………………………………………………….… **Adm** **No**: ……… **Class**:………..

**School:** ………………………………………………... **Candidate’s** **Signature**: …….…**Date**: …..…….

***Instructions to Candidates***

1. *Write your name, admission number and class in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *This paper consists of* ***two*** *sections****; Section I*** *and* ***Section II.***
4. *Answer* ***all*** *the questions in* ***Section I*** *and any* ***five*** *questions from* ***Section II***
5. ***Show all the steps in your calculations, giving your answers at each stage in the spaces 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. ***This paper consists of 16 printed pages.***
9. ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***

**For Examiner’s Use Only**

**Section I**

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

**Section II**

**Grand**

**Total**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Total** |
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**SECTION I (50 Marks)**

*Answer* ***all*** *the questions in this section in the spaces provided below each question*

1. A milk urn has a capacity of 18.48 litres. A cylindrical container of diameter 14 cm and height 10 cm is used to draw milk from the urn for sale. How many times will it be used to completely drain the milk from the urn? (3 marks)
2. An arithmetic progression is such that its first term and common difference are 3 and 2 respectively. The difference of the last and forty-first terms of this progression is 48. Find the number of terms in the progression. (3 marks)
3. Make the subject of the formula; (3 marks)
4. Find the value of p if the expression is a perfect square, given that p is a constant. (2 marks)
5. In the figure below, PT is a tangent to the circle from an external point P. PT=24 cm and OP=25 cm.



Calculate the shaded area correct to 2 decimal places. (4 marks)

1. The cost of hiring a conference facility for one day consists of two parts, one which is fixed and the other varies as the number of participants attending a conference. If Kshs. 45,000 is charged for hiring the facility for 100 participants and Kshs. 40,000 for 60 participants, find the number of participants if Kshs. 63,000 is used to hire the facility. (4 marks)
2. (a) Expand in ascending powers of up to the term in (1 mark)

(b) Use the expansion in (a) above to find the value of correct to 5 decimal place. (2 marks)

1. The cash price of a deep freezer is Kshs. 50,000. Mary bought the freezer on hire purchase terms by paying a deposit of Kshs. 25,000 followed by 24 equal monthly instalments of Kshs. 2,250 each. An annual interest, compounded quarterly was charged on the balance for a period of 2 years. Determine, correct to 1 decimal place, the interest rate per month. (4 marks)
2. The equation of a trigonometric function is . The function has a period of .
3. Identify the phase angle of the function (1 mark)
4. Determine the value of (1 mark)
5. An airport R is 4320 nautical miles to the north of another airport T (450S, 1080E). find the position of T (3 marks)
6. The table below show the number of days () and heights of tree seedlings () in a tree nursery

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of days ( | 1 | 2 | 3 | 4 | 5 |
| Height ( cm) | 3.7 | 6.0 | 7.5 | 8.3 | 8.8 |

1. On the grid provided, draw a graph to represent the information in the table given. (2 marks)



1. Use the graph to determine the rate of change of height () with the number of days at (2 marks)
2. The probability of Kisumu Day High School to win a hockey match is . If it losses in hockey, then it has a probability of winning in soccer as . Otherwise, the probability of winning the soccer match is . Calculate the probability of the school winning either of the two games. (3 marks)
3. The figure below shows a ranch ABCD drawn to a scale of 1: 100,000. A security light tower is to be installed in the ranch such that it meets the following conditions:
* It is nearer to A than it is to B
* It is at least 200 metres from the point C
* It is further from the line CD than it is to A

Shade the possible region in the ranch where the tower would be installed to meet the above conditions. (4 marks)

1. Calculate the percentage error in the perimeter of a circle of radius 3.5 cm. (3 marks)
2. Use logarithms only to evaluate, correct to 4 decimal places (4 marks)
3. Solve for x in the equation (3 marks)

**SECTION II (50 marks)**

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

1. The table below shows the heights of tree seedlings measured in a tree nursery.
2. Complete the table below. (2 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Height |  |  |  |
| 3.0 – 3.9 | 3 |  |  |
| 4.0 – 4.9 | 5 |  |  |
| 5.0 – 5.9 | 7 |  |  |
| 6.0 – 6.9 | 8 |  |  |
| 7.0 – 7.9 | 5 |  |  |
| 8.0 – 8.9 | 2 |  |  |
|  |  |  |  |

1. Use the table to calculate the standard deviation correct to decimal places. (4 marks)
2. (i) On the grid provided, draw an ogive to represent the information above. (2 marks)



1. Use the ogive to find the range of height between the 20th and the 80th percentile. (2 marks)
2. The table below show income tax rate for the year 2019.

|  |  |
| --- | --- |
| Taxable Income (Kshs. per month) | Tax rate (Kshs per Kshs. 20) |
| 1 – 12,000 | 2 |
| 12,001 – 22,500 | 3 |
| 22,501 – 33,000 | 4 |
| 33, 000 – 43,500 | 5 |
| 43,501 – 54,000 | 6 |
| 54,001 and over | 7 |

Emerick earns a basic salary of Kshs. 38,780. He is entitled to the following allowances per month: house allowance – Kshs. 10,000, medical allowance – Kshs. 3,850 and a non-taxable transport allowance of Kshs. 5,200. He is entitled to a personal tax relief of Kshs. 1,054 monthly.

Calculate:

1. Emerick’s monthly taxable income. (2 marks)
2. Emerick’s monthly Pay As You Earn. (5 marks)
3. His net monthly salary given that the following deductions are made from his monthly pay: NHIF – Kshs. 3,000, Bank loan – Kshs. 7,568, WCPS – Kshs. 780. (3 marks)
4. The figure below shows a hockey field of dimensions 60 metres by 48 m. The shaded area is an astroturf that is metres wide.



1. Form and simplify an expression in x for the:
2. Area of the field and the astroturf ; (1 mark)
3. Area covered by the astroturf. (2 marks)
4. Given that the shaded area is 220 m2,
5. find the value of ; (4 marks)
6. calculate the perimeter of the field with the turf. (3 marks)
7. , and are the vertices of the image of triangle under a transformation described by the matrix
8. Determine the coordinates of triangle (3 marks)
9. (i) On the same grid, draw triangles , (2 marks)



(ii) Describe fully the transformation **M** (1 mark)

1. Triangle is the image of triangle such that , and
2. Draw triangle on the same axes (1 mark)
3. Find a single matrix of transformation that maps triangle onto triangle (3 marks)
4. (a) Complete the table below giving the values correct to 1 decimal place. (2 marks)

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

(b) On the grid provided and using the same axes, draw the graphs of

 (4 marks)



1. Using graphs in part (b),
2. find the values of for which: (3 marks)
3. determine the values of for which: (1 mark)
4. Awuor was paid an initial salary of Kshs. 180,000 per annum with a fixed annual increment. Wasonga was paid and initial salary of Kshs. 150,000 per annum with a 10% increment compounded annually.
5. Given that Awuor’s annual salary in the 11th year was Kshs. 288,000, determine:
6. Her annual increment (3 marks)
7. The total amount of money Awuor earned during the 11 years (3 marks)
8. Determine Wasonga’s monthly earning, correct to the nearest 10 shillings during the 11th year. (4 marks)
9. The figure below represents a prism ABCDEFGH of length 6 cm. the section ADEH of the prism is a trapezium in which AD=11 cm, HE=8 cm, BG=5 cm and ∠ADE=∠DEH=900



1. Calculate correct to 1 decimal place;
2. The angle between line DG and the plane ABCD. (3 marks)
3. The angle between planes ABGH and ABCD (3 marks)
4. Calculate the volume of the prism (4 marks)
5. The figure below shows the area bound by the curve and the line



1. Find , the value of at the point of intersection of the curve and the line. (3 marks)
2. Using the trapezium rule with 4 trapezia, estimate the area of the shaded region. (4 marks)
3. By integration, calculate the exact area of the shaded region (3 marks)