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

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

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MATHEMATICS

FORM 4 PAPER 2

JULY 2024

TIME: 2 ½ HOURS

**END OF TERM TWO EXAMINATION**

**Kenya Certificate of Secondary Education 2024**

**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**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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**

**SECTION 1 (50 Marks)**

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

1. Use logarithms to evaluate; (4 marks)

$$\left(\frac{415.3 ×0.0152}{\sin(75°)}\right)^{\frac{1}{3}}$$

1. The base and perpendicular height of a triangle measured to the nearest ccentimetre are 12 cm and 8cm respectively. Find the absolute error in calculating area of the triangle (3 marks)
2. (a) Expand $\left(3+\frac{2}{x}\right)^{5}$ up-to the term $x^{4}$. (1 mark)

(b) Hence estimate the value of $\left(3.5\right)^{5}$ to 4 s.f. (2 marks)

1. Find the radius and centre of the a circle whose equation is $3x^{2}+3y^{2}-12x+18y=9$ (3 marks)
2. An aero plane leaves town $A(40˚N,155˚W)$ for town $B(40˚N,25˚E)$ using the shortest route at a speed of 300 knots. Calculate the time it takes to travel from A to B. (3 marks)
3. The third term and the sixth term of a geometric series are $3\frac{1}{3}$ and $11\frac{1}{4}$ respectively. Calculate the;
4. Common ratio (2 marks)
5. First term (1 mark)
6. The graph below is part of a straight line obtained from initial equation $y=ax^{n}.$ Use the graph to calculate the values of **a** and **n**. (4 marks)



1. Given that $A=\left(\begin{matrix}2&3\\1&4\end{matrix}\right)$ and $B=\left(\begin{matrix}-1&3\\2&-1\end{matrix}\right)$, find matrix C where $AC=B$. (3 marks)
2. A quantity P is partly constant and partly varies inversely as square of t. P = 6 when t = 6 and P = 18 when t = 3. Find t when P = 11. (3 marks)
3. A mobile phone can be purchased in cash Ksh. 30,000 or by paying Ksh. 1,750 for 24 months. Calculate the rate of interest charged on instalment buying. Give your answer correct to 2 decimal places. (3 marks)
4. Solve for $x$ in $3log\_{3}x+4=log\_{3}24$ (3 marks)
5. Solve for x in the equation

$6 sin ^{2}x-\cos(x-5=0)$ for $0°\leq x\leq 360°$ (3 marks)

1. Two brands of tea costing Sh. 160 and Sh. 140 per kilogram respectively are mixed in the ration $2:3$ by mass. The mixture is sold at Sh. 240 per kilogram. Find the percentage profit made. (3 marks)
2. Triangle $A^{'}B'C'$ is the image of triangle ABC under transformation represented by the matrix $\left(\begin{matrix}3&1\\5&4\end{matrix}\right)$. If the area of triangle $A^{'}B'C'$ is 140$ cm^{2}$, find the area of triangle ABC (3 marks)
3. Given that PR = 2cm, PN = 12cm and PM = 3cm. Find the length of:



1. PS (2 marks)
2. PQ (1 mark)
3. Given that $\tan(x=\frac{1}{\sqrt{3}})$, find the value of $tanx+\cos(x)$. (3 marks)

**SECTION II (50 Marks)**

**Answer any Five questions only in this section.**

1. In a science class, $\frac{2}{3}$ of the class are boys and the rest are girls. 80% of the boys and 90% of the girls are right handed. The probability that the right handed student will break a test tube in any session is $\frac{1}{10}$ and that for the left handed student is $\frac{3}{10}$ ,regardless of whether boy or girl.
2. Draw a tree diagram to represent this information (2 marks)
3. Using the tree diagram drawn, find the probability that:
4. A student chosen at random from the class is left handed (2 marks)
5. A test tube is broken by a left handed student. (2 marks)
6. A test tube is broken by a right handed student. (2 marks)
7. A test tube is not broken in any session (2 marks)
8. In a triangle ABC, E is the midpoint of BC, D is a point on AC such that $AD: DC=3:2$ and F is the point of intersection of AE and BD. Vectors $AB=\tilde{b}$ and $AC=\tilde{c}$



1. Express the following vectors in terms of $\tilde{b}$ and $\tilde{c}$ only
2. AE (2 marks)
3. BD (1 mark)
4. By expressing vectors BF in two ways, find the ratio $BF: FD$ given that $BF = hBD$ and $AF = tAE$ where h & t are constants (5 marks)
5. Hence find vector BF in terms of b and c only (2 marks)
6. The table below shows the rates at which income tax is charged on annual income.

|  |  |
| --- | --- |
| Annual taxable income (K£) | Rates (Sh per K£) |
| $$1-2800$$ | 3 |
| $$2801-4600$$ | 5 |
| $$4601-7200$$ | 6 |
| $$7201-9000$$ | 7 |
| $$9001-11 800$$ | 9 |
| $$11 801-13 600$$ | 10 |
| Over $13 600$ | 12 |

A company employee earns a basic monthly salary of Ksh. 18 600 and a house allowance of 15% of his basic salary. If the employee is married and claims a monthly family relief of Sh. 250, calculate;

1. His annual taxable income in Kenya pounds. (2 marks)
2. His net salary per month. (8 marks)
3. The marks obtained by 50 students in an examination were recorded in the table below

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Marks | $$0-9$$ | $$10-19$$ | $$20-29$$ | $$30-39$$ | $$40-49$$ | $$50-59$$ | $$60-69$$ | $$70-79$$ |
| Number of student | 3 | 6 | 10 | 12 | 9 | 5 | 3 | 2 |

Using 44.5 as the assumed mean, calculate

1. The actual mean mark (4 marks)
2. The standard deviation to 2 decimal place (3 marks)
3. The quartile deviation (3 marks)
4. Given that $y = 2 sin2x$ and $y = 3 cos (x +45°)$
5. Complete the table below: (2 marks)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| $$x$$ | $$0°$$ | $$20°$$ | $$40°$$ | $$60°$$ | $$80°$$ | $$100°$$ | $$120°$$ | $$140°$$ | $$160°$$ | $$180°$$ |
| $$2\sin(2x)$$ | 0 |  | 1.97 |  | 0.68 | $$-0.68$$ | $$-1.73$$ |  | $$-1.28$$ | 0 |
| $$3\cos(\left(x+45°\right))$$ | 2.12 | 1.27 |  | $$-0.78$$ |  | $$-2.46$$ |  |  | $$-2.72$$ | $$-2.12$$ |

1. Use the data to draw the graph of $y = 2\sin(2x)$ and $y = 3 cos (x +45°)$ for $0°\leq x\leq 180°$ on the same axis on the grid provided below. (5 marks)



1. State the amplitude and period of each curve (2 marks)
2. Use the graph to solve the equation $2\sin(2x-3\cos(\left(x+45°\right)=0))$ for $0°\leq x\leq 180°$

 (1 mark)

1. VABC is a pyramid standing on an equilateral triangular base ABC whose sides are 6 cm. VO is the perpendicular height. $VA=VB=VC=15 cm.$



Calculate to 2 d.p.

1. Height VO. (3 marks)
2. The inclination of VAB to ABC. (2 marks)
3. The inclination of VB to ABC. (3 marks)
4. The volume of the pyramid. (2 marks)
5. A small scale farmer wishes to buy some sheep and goats for rearing. Sheep cost Sh 400 and a goat cost Sh.300.The farmer has enough space for only 20 animals and may spend at most Sh. 6 800. The number of goats should not exceed twice the number of sheep.
6. By letting *x* and *y* to represent the number of sheep and goats he can buy respectively, write down all inequalities from the above information. (4 marks)
7. Represent the inequalities on the grid provided (4 marks)



1. From your graph, find the maximum number of animals he can buy at the lowest cost (2 marks)
2. The displacement of a particle S metres, t seconds after passing a fixed point O is given by $S=3+2t-5t^{2}$.

Calculate:

1. The displacement of the particle 2 seconds later (2 marks)
2. The time taken for the particle to return to O (3 marks)
3. The maximum displacement of the particle (3 marks)
4. The initial velocity of the particle (2 marks)