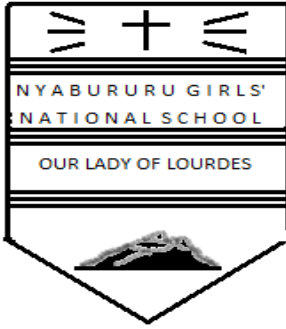


Name..... INDEX NO..... STREAM..... Sign



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MATHEMATICS PAPER 2
FORM 4 JULY SERIES
TERM 2 2017
TIME 2½ HOURS.

INSTRUCTIONS

- ❖ Write your name, admission number, stream and class number in the spaces provided above.
- ❖ This paper consists of two sections: Section I and Section II.
- ❖ Answer all the questions in Section 1 and only FIVE from section II.
- ❖ Show all the steps in your calculations, giving your answer at each stage in the spaces provided below each question.
- ❖ Marks are given for correct working even if the answer is wrong.
- ❖ Non-programmable silent electronic calculators and KNEC mathematical tables may be used.

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

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

| | |
|--------------------|--|
| GRAND TOTAL | |
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SECTION I
ANSWER ALL QUESTIONS (50 MARKS)

1. Using logarithm tables, evaluate; (4mks)

$$\left(\frac{\log 8}{79.81 \times 0.00675} \right)^{\frac{1}{3}}$$

2. By expressing in surd form, rationalize the denominator. (3mks)

$$\frac{\sqrt{7} + \tan 60^\circ}{\cos 30^\circ - \sin 45^\circ}$$

3. Make P the subject in (3mks)

$$p = \sqrt[3]{\left(\frac{p^2 + n}{M^2} + R \right)}$$

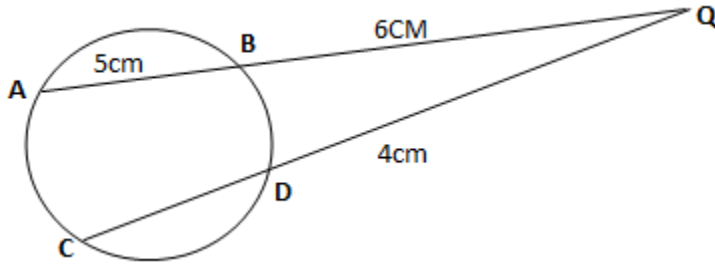
7. Solve the equation; $2 \cos \theta + 5 \sin^2 \theta = 2$ for $0^\circ \leq \theta \leq 180^\circ$. (4mks)

8. Triangle ABC with vertices A(-1,4), B(-1,2) and C(5,2) is mapped onto the image, triangle $A^1B^1C^1$ after transformation whose matrix is $\begin{pmatrix} -1 & 2 \\ 2 & -6 \end{pmatrix}$ Find the vertices of $A^1B^1C^1$ (3mks)

9. (a) Expand $(1 + 3x)^5$ in ascending powers of x up to the term x^3 and simplify. (1mk)

(b) Hence estimate the value of $(0.97)^5$ correct to 4 decimal places. (2mks)

10. Chords AB and CD in the figure below intersect externally at Q. if AB=5cm, BQ=6cm and DQ=4cm, calculate the length of chord CD. (3mks)



11. Solve for x in the given equation. (3mks)

$$64^x - 121 = 7 - 4^{3x}$$

12. Given that $y = \frac{x(x^2-1)}{x+1}$, find $\frac{dy}{dx}$ at the point (2,4) (3mks)

13. John buys and sells rice in packets. He mixes 30 packets of rice A costing sh.400 per packet with 50 packets of another kind of rice B costing sh.350 per packet. If he sells the mixture at a gain of 20%, at what price does he sell a packet? (3mks)

14. Determine the inverse, T^{-1} of the matrix $T \begin{pmatrix} 4 & 6 \\ 6 & -2 \end{pmatrix}$ hence solve (3mks)

$$2x + 3y = 30$$
$$3x - y = 10$$

15. Find the centre and radius of the circle whose equation is $4x^2 + 4y^2 - 6x + 4y - 4\frac{1}{4} = 0$ (3mks)

16. A number n is such that when 2 is added to it and squared the result is always 4. Find n . (2mks)

SECTION II (50 MARKS)

17. The table below shows the Kenya tax rates in a year.

| Income (Ksh, p.a) | Tax rate (%) |
|-------------------|--------------|
| 1 – 116160 | 10% |
| 116161 – 225600 | 15% |
| 225601 – 335040 | 20% |
| 335041 – 444480 | 25% |
| OVER 444481 | 30% |

In that year, Ushuru earned a basic salary of Kshs, 30,000 p.m. in addition, he was entitled to a medical allowance of ksh.2,800 p.m and a travelling allowance of ksh.1,800 p.m. He is housed by the employer and pays a nominal rent of ksh.2,000. He also claimed a family relief of ksh.1056 p.m.

Calculate;

(a) Ushuru’s annual taxable income. (2mks)

(b) The tax paid by Ushuru in that year. (5mks)

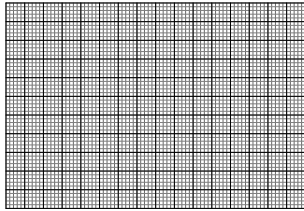
(c) Ushuru’s net income in that year, given that his other monthly deductions were (3mks)

| | |
|-------------|------------|
| Union dues | Ksh.445 |
| WCPS | Kshs. 490 |
| NHIF | Kshs.320 |
| Coop shares | Kshs 1,000 |
| Risk fund | Ksh 100 |

18. (a) Complete the table for the function $y = \frac{1}{2} \sin 2x$ where $0^\circ \leq x \leq 360^\circ$. (2mks)

| | | | | | | | | | | | | | |
|---------------------------|------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| X | 0 | 30° | 60° | 90° | 120° | 150° | 180° | 210° | 240° | 270° | 300° | 330° | 360° |
| 2x | 0 | 60° | 120° | 180° | 240° | 300° | 360° | 420° | 480° | 540° | 600° | 660° | 720° |
| Sin 2x | 0.00 | 0.87 | | | 0.00 | | | | 0.87 | | 0.87 | | |
| $Y = \frac{1}{2} \sin 2x$ | 0.00 | 0.44 | | | 0.00 | | | | | | | | |

(b) On the grid provided, draw a graph of the function $y = \frac{1}{2} \sin 2x$ for $0^\circ \leq x \leq 360^\circ$ using the scale of 1cm for 30° on the horizontal axis and 4cm for 1 unit of y axis. (3mks)



(c) Use your graph to determine the amplitude and period of the function $y = \frac{1}{2} \sin 2x$ (2mks)

(d) Use the graph to solve:

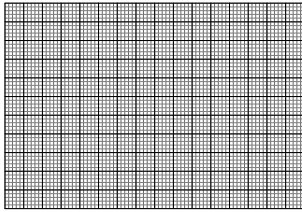
(i) $\frac{1}{2} \sin 2x^\circ = 0$ (1mk)

(ii) $\frac{1}{2} \sin 2x^\circ - 0.5 = 0$ (2mks)

19. A businessman wants to buy machines that make plastic chairs. There are two types of machines that make these chairs, type A and type B. Type A makes 120 chairs a day, occupies 20m^2 of space and is operated by 5 men. Type B make 80 chairs a day, occupies 24m^2 of space and is operated by 3 men. The businessman has 200m^2 of space on 40men.

(a) List all inequalities representing the above information given that the business man buys x machines of type A and y machines of type B. (3mks)

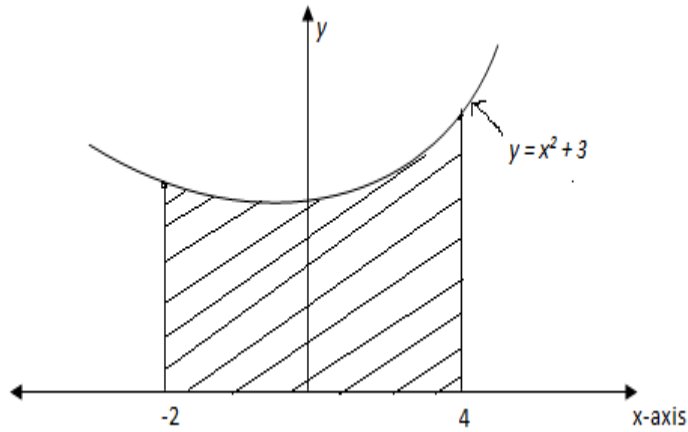
(b) Represent the inequalities above on the grid provided. (3mks)



(c) Use your graph to find the number of machines of type A and type B that the business man should buy to maximize the daily chair production. (2mks)

(d) Given that the price of a chair is Ksh. 250, determine daily sales the businessman can make. (2mks)

20. Below is a sketch of the area bounded by the curve $y = x^2 + 3$ and the line $x = -2$, $x = 4$ and $y = 0$.



(a) Estimate the area of the shaded region using 6 strips by the trapezoidal rule. (3mks)

(b) Taking the area by integration as the actual area find the area. (4mks)

(c) Find the percentage error in the approximation in (a) above. (3mks)

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21. Two biased pentahedrons have their faces numbered 1, 2, 3, 4 and 5. The probability that one of the pentahedron shows a particular face when tossed is shown below.

| | | | | | |
|-------------|---------------|----------------|----------------|---------------|----------------|
| Face | 1 | 2 | 3 | 4 | 5 |
| Probability | $\frac{1}{5}$ | $\frac{1}{10}$ | $\frac{3}{10}$ | $\frac{1}{4}$ | $\frac{3}{10}$ |

(a) One pentahedron is tossed once. What is the probability that the pentahedron.

(i) Shows an odd number. (2mks)

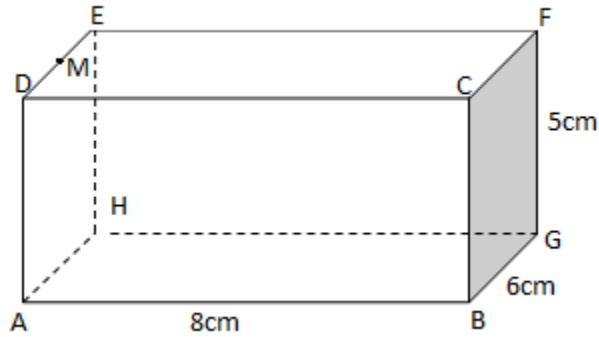
(ii) Shows a number less than 3. (3mks)

(b) The two pentahedrons are thrown at once. Find the probability that;

(i) The two pentahedron show the same number. (3mks)

(ii) The sum on the two faces is equal to 5. (3mks)

22. The figure below shows a cube ABCDEFGH of length 8cm, 6cm and height 5cm. M is the midpoint of DE.



(a) State the projection of the line BE on plane ABGH. (1mk)

(b) Calculate the length AF. (2mks)

(c) Calculate the length ME. (2mks)

(d) Calculate the angle between GD and the plane ABGH. (2mks)

(e) Calculate the angle between plane BGM and the base ABGH. (3mks)

23. A body moves in a straight line in such a way that at any time, t seconds its distance S metres from the starting point is given by $S = 8t - t^2$

(a) How fast is the body moving at; (3mks)

(i) $t = 1$ second

(ii) $t = 3$ seconds

(b) What is the maximum displacement from the starting point that the body achieves (4mks)

(c) Find the acceleration of the body. (1mk)

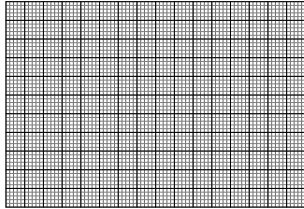
(d) After how long will the body be back to the starting point? (2mks)

24. Two variables R and P are connected by a function $\log R = \log K + \log P^n$ where k and n are constants. The table below shows data involving the two variables.

(a) Complete the table. (2mks)

| | | | | | |
|-------|----|-----|----|-----|-----|
| P | 3 | 3.5 | 4 | 4.5 | 5 |
| Log p | | | | | |
| R | 36 | 49 | 64 | 81 | 100 |
| Log R | | | | | |

(b) Draw a line graph to represent the information above. (3mks)



(c) Find the values of constant k and n. (2mks)

(d) Find the value of P when R= 900 given that $R=KP^n$ (3mks)