



# THE MATHEMATICS GURU EXAMINATION END TERM II

**121/1 – MATHEMATICS – Paper 1**

**ALT A**

**Sep. 2022 – 2½ hours**

Name: ..... Admission Number: .....

Candidate's Signature: ..... Stream: ..... Date: .....

## Instructions to Candidates

- Write your name and admission number in the spaces provided above.
- Sign and write the date of examination in the spaces provided.
- This paper consists of **two** sections; **Section I** and **Section II**.
- Answer **all** questions in **Section I** and only **five** questions from **Section II**.
- Show all the steps in your calculations, giving the answers at each stage in the spaces provided below each question.**
- Marks may be given for correct working even if the answer is wrong.
- Non-programmable** silent electronic calculators **and** KNEC mathematical tables may be used, except where stated otherwise.
- This paper consists of 16 printed pages.**
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- Candidates should answer the questions in English.**

## 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(50 marks)**

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

1. Composite numbers between 11 and 21 exclusive are arranged in descending order to form a number P. Prime numbers between 0 and 10 are arranged in ascending order to form a number Q. Express the total value of the third digit of  $P - 4Q^2$  in standard form. (4 marks)

2. A square floor of a room is to be covered by rectangular slabs of dimensions 0.50 m by 0.42 m. Find the smallest number of tiles that can be used. (2 marks)

250

3. Solve for  $n$  in the following equation without using a calculator or a mathematical table, (3 marks)
- $$\frac{32^{-n}}{5^{2n}} \div 128 = \sqrt[3]{\frac{256}{160^{6n}}}$$

4. The sum of the interior angles of a regular polygon is 287.5 times the size of each exterior angle. Find the size of each exterior angle. (4 marks)

5. Use squares, square roots, reciprocal and cube tables to evaluate the following:

$$\sqrt[3]{14.41^2} - \frac{15}{\sqrt{0.9642}}$$

(4 marks)

6. Given that  $24 \sin \theta - 7 \cos \theta = 0$ , find  $\sin (90 - \theta)$  without using a mathematical table or a calculator.

(3 marks)

7. A point  $R(3, 6)$  is given a negative three-quarter turn about  $(1, -2)$  followed by a reflection along line  $y = mx + c$  to form  $R'(-2, 8)$ . Find the equation of the mirror line. (4 marks)

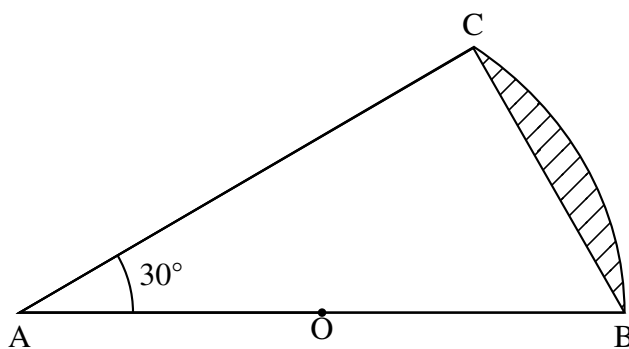
8. State the integral values that satisfy the following simultaneous inequalities:

$$5 - 2x < x + 12$$

$$3x + 1 \leq x + 8$$

(3 marks)

9. The figure below shows a part of a circle in which  $AB$  is the diameter and  $BC$  is a chord of length 4.9 cm, angle  $BAC = 30^\circ$  and  $O$  is the centre of the circle.



Calculate the area of the shaded segment correct to four significant figures. (Take  $\pi = \frac{22}{7}$ ) (3 marks)

10. A Kenyan charity organization received some donation from United State, in US dollars. The money was converted into Kenyan shillings in a bank which buys and sells currencies as follows:

	Buying (Ksh)	Selling (Ksh)
1 US Dollar	102.40	102.50
100 Japanese Yen	92.80	93.00

The Charity spent 70% of the money to buy a van and Ksh.102000 to pay school fees. The rest of the money was converted to Japanese Yen. If the organization received 1 872 258.50 Yens from the bank, determine how much donation, to the nearest US dollars, the organization received. (3 marks)

11. Given that  $\mathbf{OP} = 2\mathbf{i} + 3\mathbf{j}$ ,  $\mathbf{OQ} = 3\mathbf{i} - 4\mathbf{j}$ ,  $\mathbf{OR} = 7\mathbf{j} - 2\mathbf{i}$  and  $\mathbf{OB} = 2\mathbf{OP} + 3\mathbf{QR}$ , find the coordinates of B. (3 marks)

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12. The distance between towns A and B is 450 km. A bus left town A at 0815 h and travelled towards town B at 80 km/h. At 0830 h, a car left town B for town A. If the two vehicles met at 1040 hours, determine the speed of the car. (3 marks)

13. Simplify  $\frac{12y^3 - 18xy^2 - 12x^2y}{12y^3 - 3x^2y}$  (3 marks)

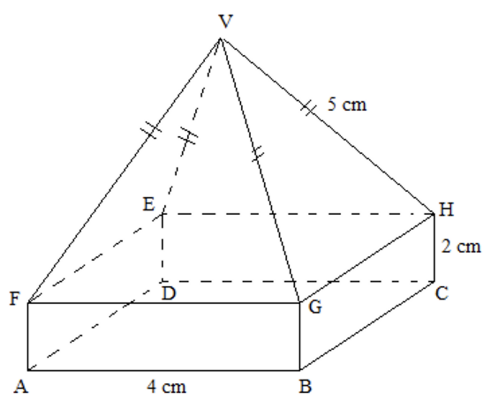
14. 1400 cm<sup>3</sup> of fresh water of density 1 g/cm<sup>3</sup> is mixed with  $x$  cm<sup>3</sup> of liquid L of density 1.25 g/cm<sup>3</sup>. If the density of the mixture is  $1\frac{2}{15}$  g/cm<sup>3</sup>, determine the value of  $x$  (3 marks)

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15. Five men each working 10 hours a day, take two days to cultivate one acre of land. The men are sent to work on a four acre piece of land at the same rate. After working for two days, they are joined by three more men and started working together now for 6 hours a day. How long did they take to complete the remaining work? (3 marks)

16. The figure below shows a model of a hut (not drawn to scale). Draw the accurate net of the model.

(2 marks)



**SECTION II(50 marks)**

*Answer only five questions from this section in the spaces provided.*

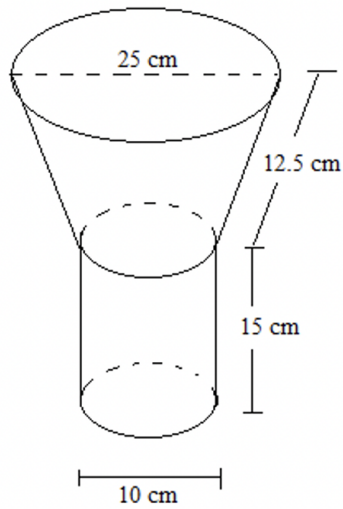
17. A sales woman is paid a basic salary of Ksh.18000 per month for selling laptops marked at Ksh.45000 each. In addition, she is paid commission at the rate given below:

Sales	Commission
0 – 500000	0%
500001 – 750000	3%
750001 – 1000000	5%
Above Ksh.1000000	8%

- (a) During a certain month, she sold 30 laptops at  $11\frac{1}{9}\%$  discount. Calculate:
- (i) the amount of commission she earned that month; (3 marks)
- (ii) her total earnings that month. (1 mark)
- (b) The following month, the sales womans monthly salary was increased by 10%. Her total earnings that month were Ksh.77400. Calculate:
- (i) the total amount of sales of laptops that month; (3 marks)
- (ii) the percentage discount she allowed that month per laptop if 35 pieces were sold. (3 marks)



18. The figure below shows a flower vase. The lower part of the vase is a cylinder of diameter is 10 cm and height 15 cm while the upper part is a frustum of a cone with top diameter 25cm and slant height of 12.5 cm.



- (a) Calculate the height of the vase. (4 marks)

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- (b) Using  $\pi = 3.142$ , calculate, correct to 1 decimal place:

- (i) the volume of the vase; (3 marks)

- (ii) the surface area of the vase. (3 marks)

19. Karuku, Jaoko and Ezra contributed a total of Ksh.3519000 to purchase a van. The ratio of Karukus contribution to Jaokos contribution was 4 : 3 while Ezras contribution to Karukus contribution was 5 : 7.

(a) Determine the amount each contributed towards the project. (4 marks)

(b) The van purchased had a capacity of 14 seats including the drivers seat and charges Ksh.650 from Migori to Kisumu. The van operates from Migori to Kisumu and back to Migori on a daily basis for six days per week. On a daily basis, Ksh.10000 collected is used in fueling the van, 31% of the remainder is set aside for maintenance and drivers salary and the rest is saved for the owners which will be divided in the ratio of their contribution. Determine:

(i) the amount saved for the maintenance of the van after 56 weeks if the driver was paid a total of Ksh.268800; (3 marks)

(ii) the amount each received after 56 weeks. (3 marks)

20. Four towns A, B, C and D are such that B is 300 km on a bearing of  $046^\circ$  from A, the bearing of B from C is  $320^\circ$  on a distance of 420 km, the bearing of C from D is  $075^\circ$  and the bearing of A from D is  $300^\circ$ .

(a) Using a scale of 1 : 500,000, locate the positions of the four towns. (4 marks)

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(b) Using the diagram drawn in (a) above, determine:

(i) the distance between towns A and D; (2 marks)

(ii) the distance between towns C and D; (2 marks)

(iii) the distance and bearing of A from C. (2 marks)

21. The diagram below shows the frequency polygon for the heights in cm for 50 seedlings.



- (a) Using the values obtained from the polygon above, calculate the mean height of the seedlings.

(3 marks)

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- (b) Given that the modal class is 11 – 14,

- (i) draw a frequency distribution table for the data represented in the frequency polygon;

(2 marks)

(ii) Hence, estimate the median height.

(3 marks)

(c) Calculate the percentage of the seedlings whose heights are at least 15 cm.

(2 marks)

22. (a) Determine the inverse of the matrix  $\mathbf{AB}$  given that  $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}$  and  $\mathbf{B} = \begin{pmatrix} 1 & 3 \\ 1 & -1 \end{pmatrix}$  (4 marks)

(b) Keter bought 3 goats and 21 sheep and paid Ksh.103500. Weke bought 36 goats and 21 less sheep than Keter and he paid Ksh.4500 more than what Keter paid. Using the inverse in (a) above, determine the cost of each animal. (3 marks)

(c) In the following months, the price of each goat increased by 30% while that of each sheep decreased by 5%. Namachanja bought 20 goats and 18 sheep. Determine how much he paid. (3 marks)

23. (a) Complete the table below for the function  $y = x^3 - x^2 - 9x + 9$ . (2 marks)

$x$	-4	-3	-2	-1	0	1	2	3	4	5
$y = x^3 - x^2 - 9x + 9$	-35	0								64

- (b) Estimate the area bounded by the curve  $y = x^3 - x^2 - 9x + 9$ , the lines  $y = 0$ ,  $x = -3$  and  $x = 3$  using:

- (i) Trapezium rule with 6 trapezia; (2 marks)

- (ii) Mid-ordinate rule with 3 strips. (2 marks)

- (c) Using integration, find the exact area bounded by the curve  $y = x^3 - x^2 - 9x + 9$ , lines  $y = 0$ ,  $x = -3$  and  $x = 3$ . Hence determine the percentage error in using the mid-ordinate rule. (4 marks)

24. The equation of a curve is given as  $y = ax^2 + \frac{2}{3}x - 2$ . The equation of its normal at a point N is given as  $y = -3x + c$ . Find:

(a) the value of  $a$ ; (2 marks)

(b) the coordinates of N and the value of  $c$ ; (3 marks)

(c) the coordinates of the turning point of the curve and its nature; (3 marks)

(d) Sketch the curve for the function  $y = ax^2 + \frac{2}{3}x - 2$  (2 marks)

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