

NAME: ..... INDEX NUMBER: .....STR.....

SCHOOL..... ADM NO.....

DATE.....

MATHEMATICS ALT A

121/1

**Paper 1**

Time: 2 ½ hours

**NYAHOKAKIRA CLUSTER III EXAMINATION 2022**

Kenya Certificate of Secondary Education



**INSTRUCTIONS TO CANDIDATES**

- (a) Write your **name** and **index number** in the spaces provided above.
- (b) This paper consists of **TWO sections: Section I** and **Section II**.
- (c) Answer **ALL** the questions in **Section I** and **only five questions** from **Section II**.
- (d) All answers and workings must be written on the question paper in the spaces provided below each question.
- (e) Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
- (f) Marks may be given for correct working even if the answer is wrong
- (g) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
- (h) This paper consists of **14 printed pages**.
- (i) 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**

17	18	19	20	21	22	23	24	Total

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Grand Total

*This paper consists of 14 printed pages. Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing.*

**SECTION I (50 MARKS)**

*Answer all questions in this section*

1. Given that  $a = 3$ ,  $b = 5$  and  $c = -\frac{1}{2}$  evaluate  $\frac{4a^2 + 2b - 4c}{\frac{1}{4}(b^2 - 3a)}$  (3mks)

2. Solve for  $x$  in the equation  $125^{-x} \times 5^{2(x-2)} = 25^{(x+2)}$  (3mks)

3. A salesman earns a commission of 25% on sales made. In the month of April 2018, his sales amounted to Ksh 245 000 after giving buyers a 2% discount. Calculate the amount in commission he lost as a result of the discount (3mks)

4. Simplify the expression

$$\frac{3x^2 - 4xy + y^2}{18x^2 - 2y^2}$$

(3mks)

5. Use square roots, reciprocal and square tables to evaluate to 4 significant figures the expression;

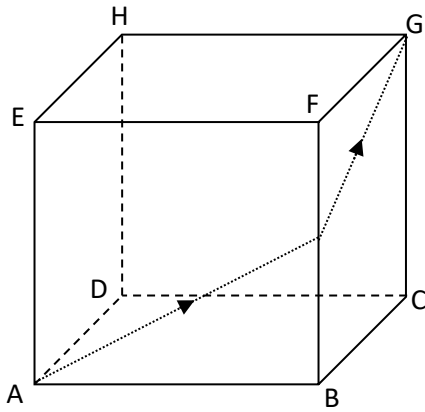
$$(0.06458)^{\frac{1}{2}} + \left(\frac{2}{0.4327}\right)^2 \quad (3\text{mks})$$

6. Three similar pieces of timber of length 240cm, 320cm and 380cm are cut into equal pieces. Find the largest possible area of a square which can be made from any of the three pieces. (3mks)

7. The exterior angle of a regular polygon is  $\frac{1}{3}$  of its interior angle. Find the sum of the interior angles of the polygon (3mks)

8. From a viewing tower 40 metres above the ground, the angle of depression of an object on the ground is  $36^\circ$  and the angle of elevation of an aircraft vertically above the object is  $48^\circ$ . Calculate the height of the aircraft above the ground. (3mks)

9. The figure below represents a closed cube ABCDEFGH of length 3 cm with a thin string fixed at vertex A through the midpoint of BF to vertex G. Draw the net of the solid showing the path of the string (3mks)

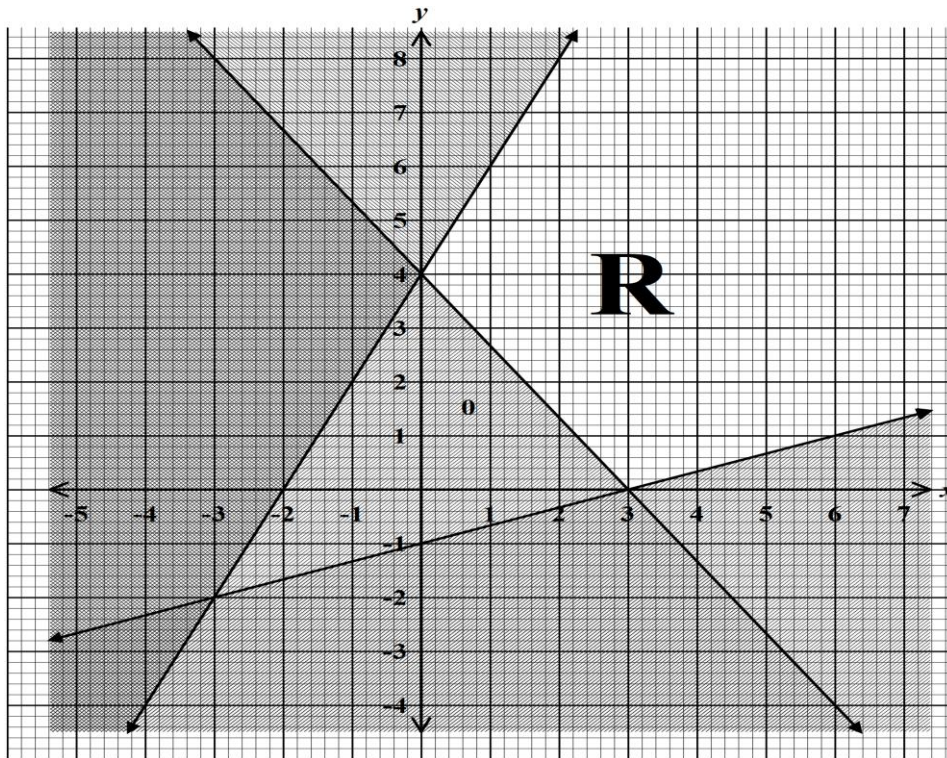


10. A cylinder of radius 15 cm and height 24 cm is filled with water. A solid hemisphere of radius 7cm is submerged into the cylinder and removed. Find the change in height of water level in the cylinder.

(3mks)

11. State the inequalities that satisfy the region defined by R.

(3mks)



12. The distance from **A** to **B** is  $d$  km and that from **B** to **C** is  $x$  km. If a bus maintains an average speed of 50 km/h between **A** and **B** and 60 km/h between **B** and **C**, it takes 3 hours to travel from **A** to **C**. If it maintains 60 km/h between **A** and **B** and 50 km/h between **B** and **C**, the journey takes 8 minutes less. What is the distance from **A** to **C** via **B**? (4mks)

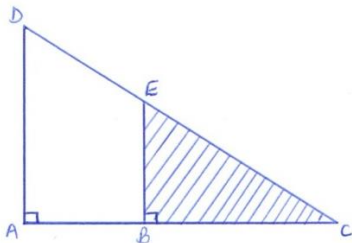
13. Given that  $\frac{2x-y}{x-2y} = 4$ , find the ratio  $y : x$

(3mks)

14. The velocity  $V$  m/s of a particle in motion is given by  $V = 3t^2 - 2t + 5$ . Calculate the distance travelled by the particle between  $t = 2$  seconds and  $t = 6$  seconds. (3mks)

15. Given that, the coordinates of two points  $P$  and  $Q$  are  $(2, 3, 5)$  and  $(6, k - 1, 15)$  respectively and that their position vectors are parallel, Calculate the value of  $|PQ|$ . (4mks)

16. Find the area of the shaded region in the figure below given that  $AD = 15$  cm,  $BE = 3$  cm,  $AB = 3$  cm,  $\angle DAB = \angle EBC = 90^\circ$ . (3mks)



**SECTION II (50 MARKS)**

**Answer any five questions in this section**

17. Using a ruler and a pair of compasses only: -

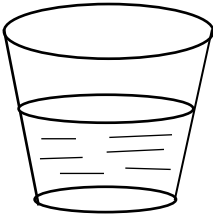
(a) (i) Construct a parallelogram PQRS, where  $PQ = 10$  cm,  $QR = 7$  cm and  $\angle PQR = 150^\circ$  (3mks)

(i) Bisect  $\angle PQR$  and  $\angle SPR$  so that the angle bisectors meet at X (1mk)

(ii) Construct a perpendicular from X to meet PQ at M. Measure XM (3mks)

(b) Calculate the area of triangle PXQ (3mks)

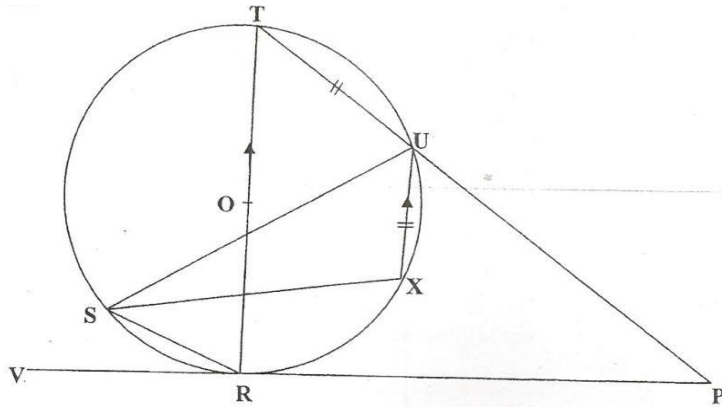
18. a) The diagram below shows a bucket in the shape of a frustum of a cone with diameters 36 cm and 24 cm and a vertical height of 28 cm. The bucket contains water such that the diameter of the water surface is 30cm. Calculate the volume of the bucket. (6mks)



b) If the bucket above has a hole and  $1.1 \text{ cm}^3$  of water leaks out every 5 seconds and collects in a cylindrical can of base radius and height 10 cm and 25 cm respectively. Calculate how long it takes to fill the cylindrical can. (4mks)



19. In the figure below, O is the centre of the circle. TOR is the diameter and PRV is tangent to the circle at R.



Given that  $\angle SUR = 25^\circ$ ,  $\angle URP = 60^\circ$ ,  $TU = UX$  and  $XU$  is parallel to the diameter; giving reasons calculate;

a)  $\angle TOU$  (2mks)

b)  $\angle XUP$  (2mks)

c)  $\angle STR$  (2mks)

d) Reflex  $\angle SXU$  (2mks)

e)  $\angle RPU$  (2mks)

20. A line  $L_1$  passes through the points  $(-2, 3)$  and  $(-1, 6)$  and is perpendicular to  $L_2$  at  $(-1, 6)$ .

a) Find the equation of  $L_1$ . (2mks)

b) Find the equation of  $L_2$  in the form  $ax + by - c = 0$  where  $a$ ,  $b$  and  $c$  are constants. (2mks)

c) Given that another line  $L_3$  is parallel to  $L_1$  and passes through point  $(1, 2)$ , find the  $x$  and  $y$  intercepts of  $L_3$ . (3mks)

d) Find the point of intersection of  $L_2$  and  $L_3$ . (3mks)

21. The masses of 40 students were measured to the nearest kilogram and recorded as shown below.

52	58	54	x	y	53	56	51
43	41	53	58	54	65	58	59
49	63	49	49	47	45	46	52
52	55	52	55	49	47	53	63
42	45	46	48	60	49	48	53

(a) Find x and y if  $x + y = 110$   
 $y - x = \sqrt{64}$  (2mks)

(b) Using a class interval of 5, that is 41 – 45, 46 – 50.....

i). Make a frequency distribution table. (2mks)

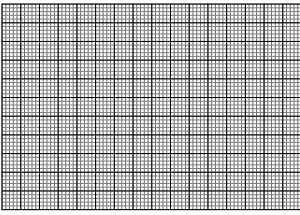
(ii). Calculate the mean mass. (3mks)

iii) calculate the median mass (3mks)

22. The coordinates of a triangle ABC are A(1, 1) B(3, 1) and C(1, 3).

(a) Plot the triangle ABC.

(1mk)



(b) Triangle ABC undergoes a translation vector  $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ . Obtain the image of A' B' C' under the transformation, write the coordinates of A' B' C'.

(2mks)

(c) A' B' C' undergoes a reflection along the line  $X = 0$ , obtain the coordinates and plot on the graph points A'' B'' C'', under the transformation

(2mks)

(d) The triangle A'' B'' C'', undergoes an enlargement scale factor -1, centre origin. Obtain the coordinates of the image A''' B''' C'''.

(2mks)

(e) The triangle A''' B''' C''' undergoes a rotation centre (1, -2) angle  $120^\circ$ . Obtain the coordinates of the image A<sup>iv</sup> B<sup>iv</sup> C<sup>iv</sup>.

(2mks)

(f) Which triangles are directly congruent.

(1mk)

23. Matrix P is given by  $\begin{pmatrix} 4 & 7 \\ 5 & 8 \end{pmatrix}$

(a) Find the inverse of P

(2mks)

(b) Two schools, Elimu and Star Academy purchased beans at sh. **B** per bag and maize at sh. **M** per bag. Elimu purchased 12 bags of beans and 21 bags of maize for shs 71,400. Star Academy purchased 10 bags of beans and 16 bags of maize for shs 57,400

(i) Form a matrix equation to represent the information

(2mks)

(ii) Use the inverse matrix of P to find the prices of one bag of each item

(4mks)

(c) The price of beans later increased by 5% and that of maize remained constant. Elimu bought the same quantity of beans but spent the same total amount of money as before on the two items. Find the new number of bags of maize bought

(2mks)

24. (a) Complete the table below for the function  $y = 3x^2 - 2x + 5$  (1mk)

$x$	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
$y$	38		21		10		5		6		13		26		45		70

b. Estimate the area bounded by the curve, the  $x$  – axis and the lines  $x = -3$  and  $x = 5$  with eight strips using

i) Trapezoidal rule (2mks)

ii) Mid ordinate rule (2mks)

c. Calculate the actual area in part b above. (3mks)

d. Calculate to 3 significant figure the percentage error when mid ordinate rule is used to estimate the area. (2mks)