Name.....Index Number.....
121/2
MATHEMATICS ALT A
Paper 2
KCSE NOVEMBER 2019
PANGANI GIRLS SCHOOL
Instructions to candidates
Answer all the questions in the spaces provided.

SECTION I – (50 MARKS).

1. Simplify $\frac{\sqrt{5}+3}{\sqrt{5}-2}$. Given the answer in the form $a + b\sqrt{c}$ where a, b *and* c are integers. (2 marks)

2. Two types of flour X and Y, cost ksh 60 and ksh 72 per kilogram respectively. The two types are mixed such that the cost of a kilogram of the mixture is ksh 70. Calculate the ratio X:Y of the mixture. (3 marks)

3. A quantity P varies inversely as the square of another quantity L. When P = 0.625, L = 4. Determine P when L = 0.2. (3 marks)

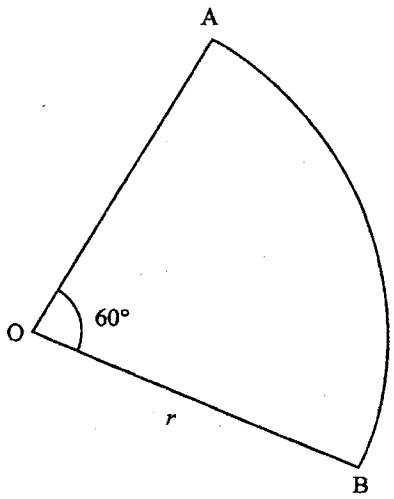
4. An arc of a circle subtends an angle of 150° at the circumference of the circle. Calculate the angle subtended by the same arc at the centre of the circle. (2 marks)

5. Solve the equations: (4 marks)
$x + 3y = 13$
$x^2 + 3y^2 = 43$

6. A bag contains 6 red counters and 4 blue counters. Two counters are picked from the bag at random, without replacement.
   a) Represent the events using a tree diagram. (1 mark)

   b) Find the probability that the two counters picked are of the same colour. (2 marks)

7. OAB is a sector of a circle of radius rcm. Angle AOB=60°. Find, in its simplest form, an expression in terms of r and π for the perimeter of the sector. (2 marks)



8. In a mathematics test, the scores obtained by 30 students were recorded as shown in the table below.

Score(x)	59	61	65	K	71	72	73	75
No. of students	2	3	5	6	7	4	2	1

The score K with a frequency of 6 is not given. Given that $\frac{\Sigma fd}{\Sigma f} = -1.2$ where $d = x - 69$, and using an assumed mean of 69, determine score K. (4 marks)

9. The table below shows income and tax rates in a certain year.

Monthly income ksh	**Tax rate in each shilling (%)**
0-10164	10
10165 – 19740	15
19741 – 29316	20
29317 – 38892	25
38893 and above	30

In that year, Mawira earned a salary of ksh 41000 per month. Calculate Mawira's income tax per month given that a monthly tax relief of ksh 1162 was allowed. (3 marks)

10. The position vectors of points A, B and C are $\boldsymbol{OA} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}, \boldsymbol{OB} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \boldsymbol{OC} = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$ show that, A, B and C are collinear. (3 marks)

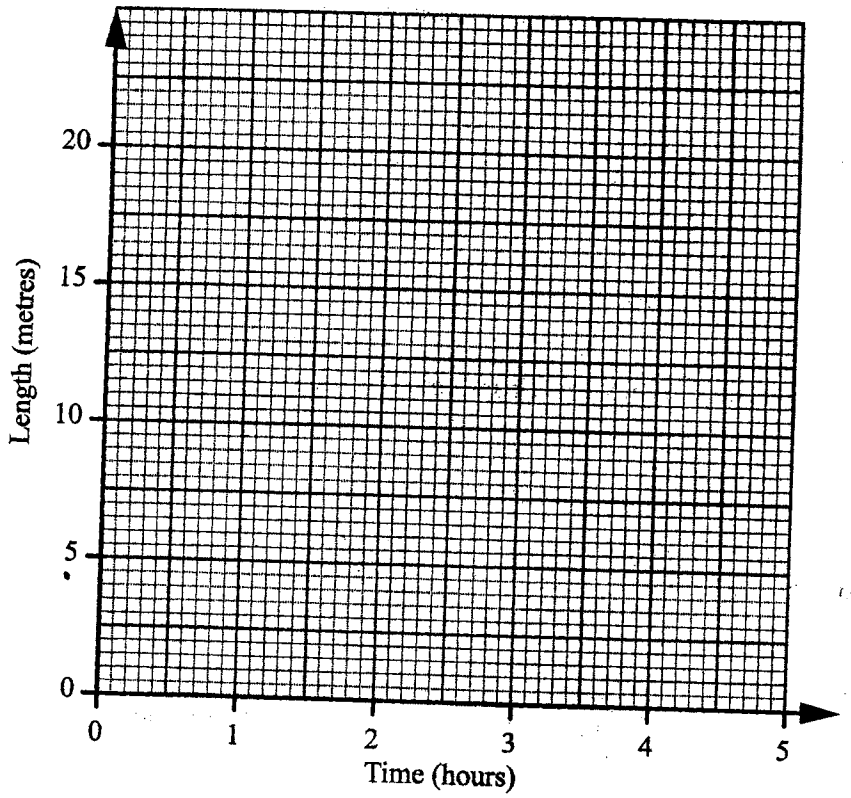
11. The vertices of a triangle PQR are P(-3,2), Q(0,-1) and R(2,-1). A transformation matrix M, maps triangle PQR onto triangle P'Q'R' whose vertices are P'(-7,2), Q'(2,-1) and R'(4,-1). Find M^{-1}, the transformation that maps P'Q'R' onto PQR. (4 marks)

12. Solve for x in $\log(7x-3)+2log5=2+\log(x+3)$. (4 marks)

13. The length of a shadow of a mast was measured at intervals of 1 hour and recorded as shown in the table below.

Time (h)	0	1	2	3	4	5
Length (m)	18.7	8.7	5.0	2.9	1.3	0

a) On the grid provided, draw the graph of length against time. (2 marks)

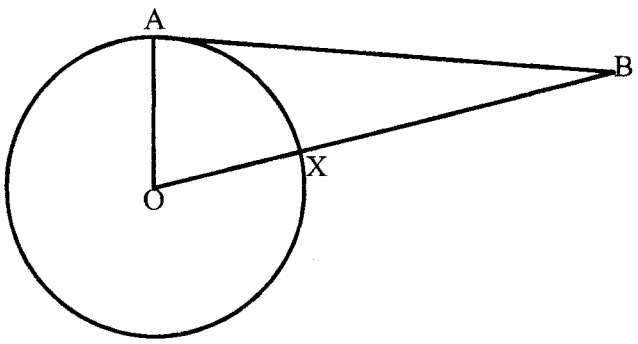


b) Determine the rate of change of the shadow length at $t = 2$. (2 marks)

14. Expand $(x + y)^4$. (3 marks)

15. The cash price of a television set is shs 25000. A customer paid a deposit of shs 3750. He repaid the amount owed in 24 equally monthly instalments. He was charged simple interest at the rate of 40% p.a. How much was each installment? (3 marks)

16. In the figure below AB is a tangent to the circle centre O, and radius 12cm. the area of triangle AOB is 120cm2. OXB is a straight line.



Calculate XB. (3 marks)

Section II

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

17. The first term of a Arithmetic Progression (AP) is equal to the first term of a Geometric Progression (GP). The second term of the AP is equal to the fourth term of the GP while the tenth term of the AP is equal to the seventh term of the GP.

a) Given that a is the first term and d is the common difference of the AP while r is the common ratio of the GP, write the two equations connecting the AP and the GP. (2mks)

b) Find the value of r that satisfies the progressions. (4 marks)

c) Given that the tenth term of the GP is 5120, find the values of a and d. (2 marks)

d) Calculate the sum of the first 20 terms of the AP. (2 marks)

18. Mbaka bought some plots at ksh 400 000 each. The value of each plot appreciated at the rate of 10% per annum.

a) Calculate the value of a plot after 2 years. (2 marks)

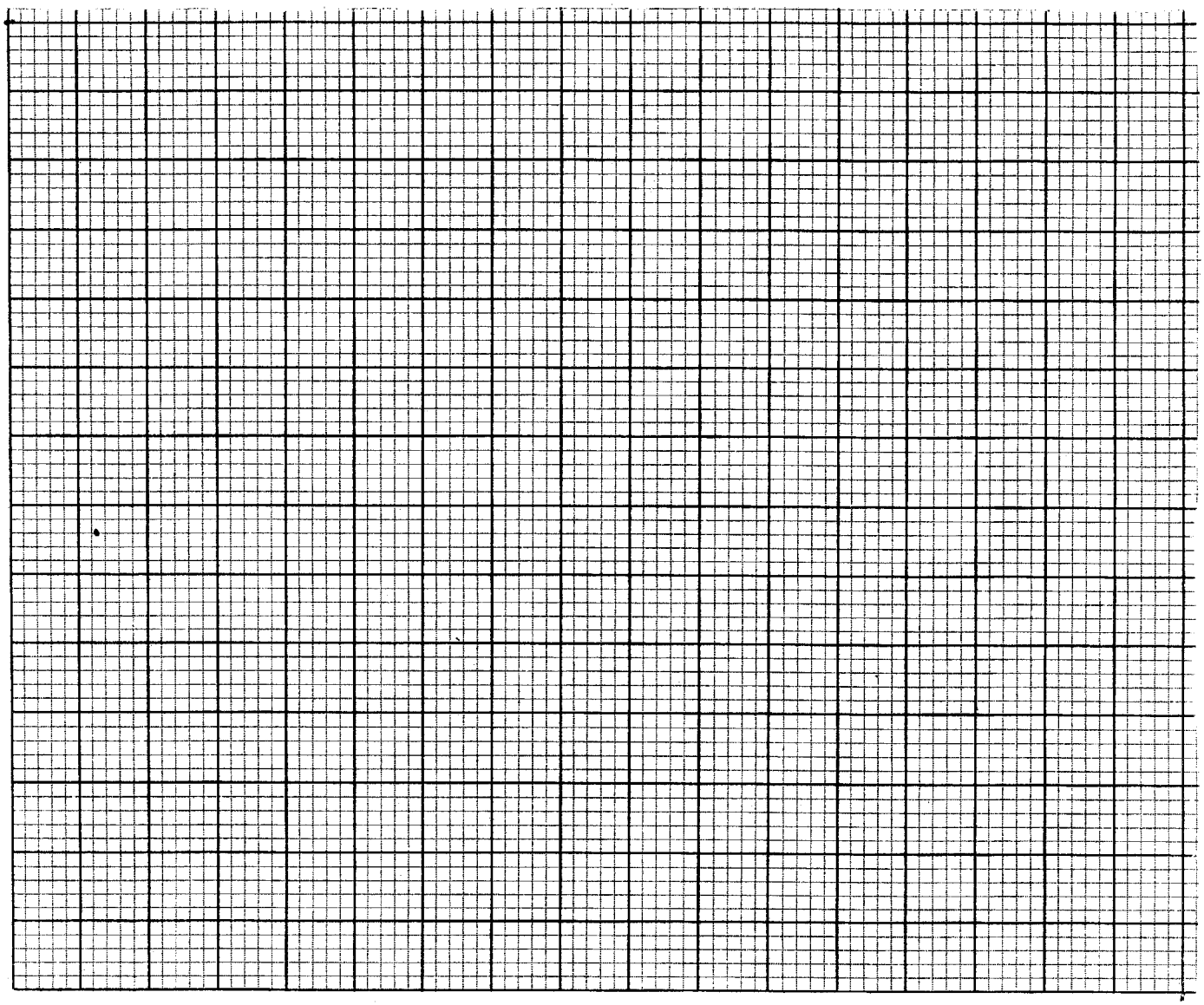
b) After some time t, the value of a plot was ksh 558 400. Find t, to the nearest month. (4 marks)

c) Mbaka sold all the plots he had bought after 4 years for ksh 2928200. Find the percentage profit Mbaka made, correct to 2 decimal places. (4 marks)

19. The amount of money contributed by a group of students during a fundraising for a needy student was as shown in the table below.

Amount (ksh)	301-400	401-500	501-600	601-700	701-800	801-900	901-1000
No. of students	2	10	12	14	7	3	2

a) On the grid provided, draw an ogive to represent the data. (4 marks)



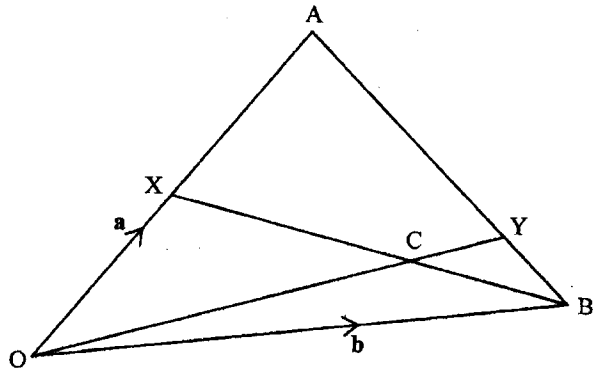
b) Use the graph to estimate:

(i) The median; (1 mark)

(ii) The quartile deviation; (3 marks)

(iii) The percentage number of students who contributed at least ksh 750.50. (2mks)

20. In the figure below, **OA=a**, **OB=b** and BX meets OY at C. **OX:OA**=1:2 and **BY:YA**=1:3.



a) Express in terms of **a** and **b**:

(i) **BA**; (1 mark)

(ii) **OY**; (2 marks)

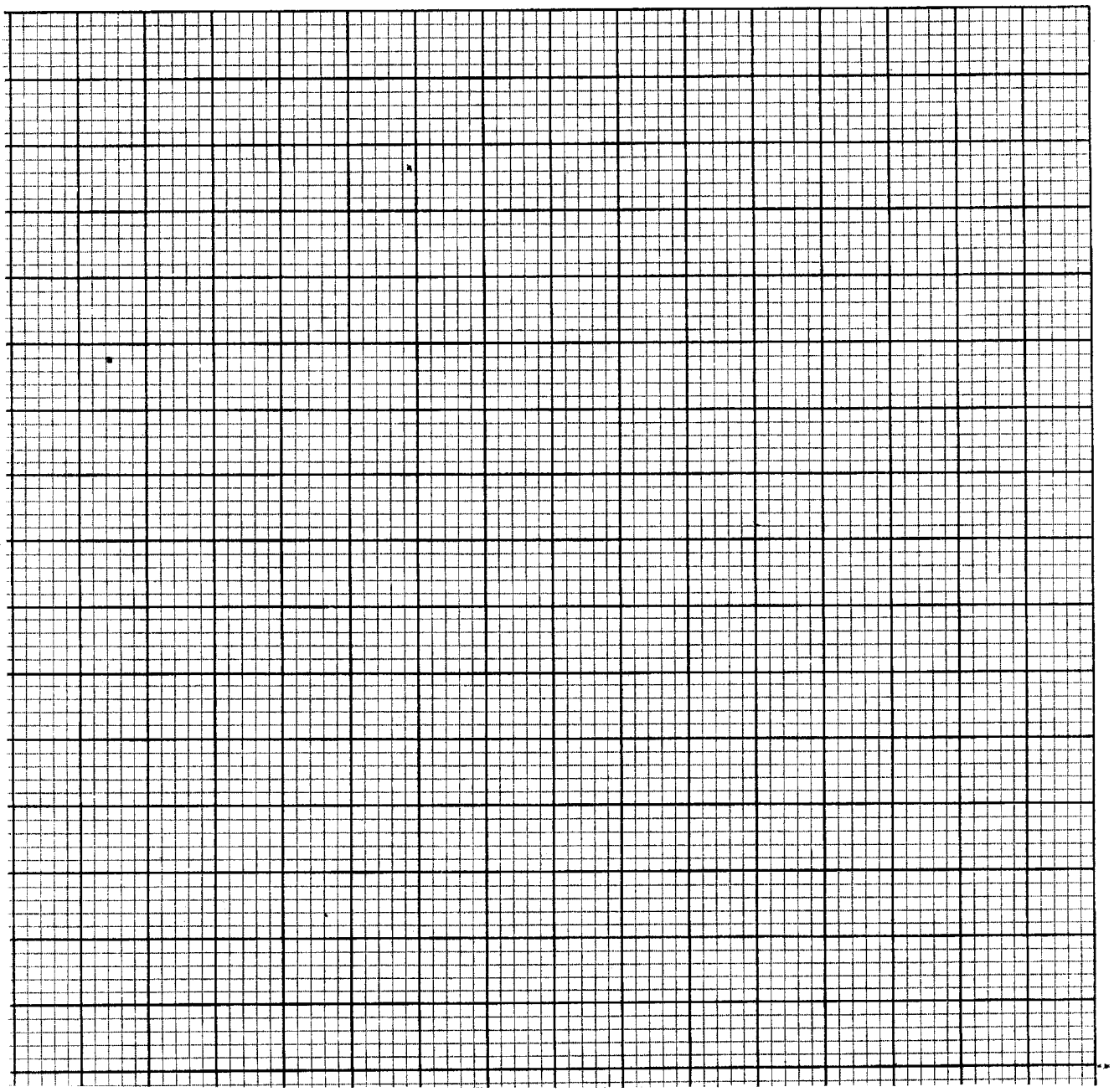
(iii) **BX**; (1 mark)

b) Given that **OC=hOY** and **BC=kBX**, determine the values of h and k. (6 marks)

21. A trapezium PQRS with vertices P(2,2), Q(6,2), R(6,4) and S(2,8) is mapped onto P'Q'R'S' by a transformation matrix $M = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

a) Find the coordinates of P'Q'R'S'. (2 marks)

b) On the grid provided draw PQRS and its image P'Q'R'S'. (2 marks)



c) (i) Find P''Q''R''S'', the image of P'Q'R'S' under the transformation matrix,

$$N = \begin{pmatrix} -\frac{1}{2} & 0 \\ 0 & -\frac{1}{2} \end{pmatrix}.$$ (1 mark)

(*ii*) On the same grid draw P''Q''R''S''. (1 mark)

d) (i) Find a single matrix that maps P''Q''R''S'' onto P'Q'R'S'. (2 marks)

(ii) Describe fully the transformation that maps P''Q''R''S'' onto P'Q'R'S'. (2 mks)