



# MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

MOCK EXAMINATIONS 2021

121/2

MATHEMATICS

Paper 2

December 2021 – TIME  $2\frac{1}{2}$  Hours

Name: ..... Adm No: .....

Class: ..... Candidate's Signature: ..... Date: ...../12/2021.

## Instructions to Candidates

- Write your name, admission number and class in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- This paper consists of **two** sections; **Section I** and **Section II**.
- Answer **all** the questions in **Section I** and any **five** questions from **Section II**
- Show **all the steps in your calculations, giving your 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 **20** printed pages.
- 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

Grand  
Total

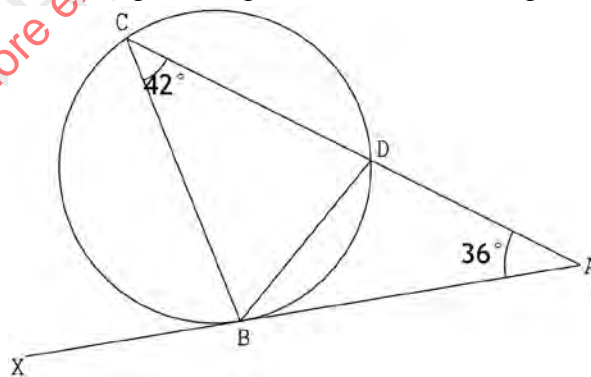
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**SECTION (50 Marks)**

Answer **all** the questions in this section in the spaces provides

1. A school bursar wishes to obtain the sum of the following amounts of money paid in as school fees for three students by the CDF: Ksh 20 760, Ksh 49 105 and Ksh 17 352. The bursar estimates the sum by first rounding each of the amounts to 3 significant figures.
  - a) Determine the estimated sum (1 mark)
  - b) Determine the percentage error in this estimate (2 marks)
2. Solve for  $x$  in :  $\log_5(3x-2) + \log_5(2x-1) = 0$  without using mathematical tables or calculator. (3 marks)

3. In the figure below, ABX is a tangent. Angle CAB =  $36^\circ$  and angle ACB =  $42^\circ$ .



Calculate the size of angle BDC

(2 marks)

4. Make  $P$  the subject of the formula in  $L = \pi \sqrt{\frac{x - PT}{Py}}$  (3 marks)

5. Given that  $\tan 15^\circ = 2 - \sqrt{3}$ , simplify  $\frac{1}{\tan 15^\circ}$ . (2 marks)

6. Solve the equation  $5\cos^2 \theta + 2 = 3\sin^2 \theta - 2\cos \theta$  for the range  $0^\circ \leq \theta \leq 360^\circ$  (4 marks)

7. Solve the simultaneous equation  $\begin{matrix} 2x - y = 3 \\ x^2 - xy = -4 \end{matrix}$  (4 marks)

8. Use binomial expansion to simplify  $(\sqrt{2} + \sqrt{5})^4 - (\sqrt{2} - \sqrt{5})^4$  (4 marks)

9. The life expectancy in hours of 40 bulbs are shown in the table below.

Expectancy (hours)	90–94	95–99	100–104	105–109	110–114	115–119
Frequency (f)	3	10	12	9	4	2

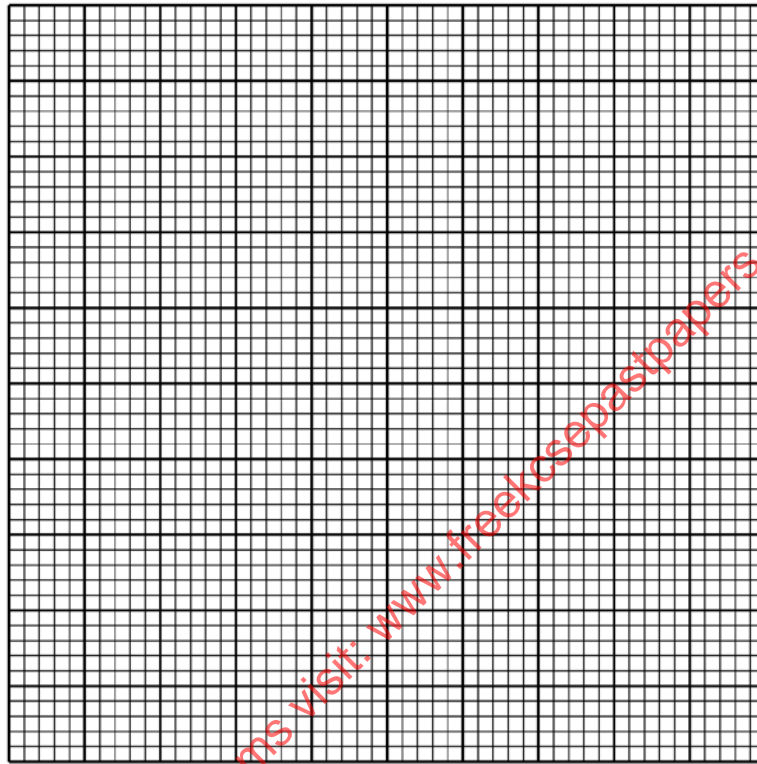
- Calculate the quartile deviation of the life expectancy (4 marks)

10. Given that  $y$  is inversely proportional to  $x^n$  and  $k$  is the constant of proportionality and that  $x = 2$ , when  $y = 4\frac{1}{2}$ , and  $x = 3$ , when  $y = 1\frac{1}{3}$ . Find the values of  $n$  and  $k$ . (4 marks)

11. A poultry farmer vaccinated 640 of his 700 chicken against a disease. Two months later 15% of the vaccinated and 70% of the unvaccinated chicken contracted the disease. Calculate the probability that the chicken chosen at random contracted the disease. (3 marks)

12. A pilot leaves point  $T(60^\circ S, 15^\circ W)$  and flies due East for a distance of  $1260nm$  to a point  $U$ . Determine the position of  $U$ . (3 marks)

13. The equation of a circle is given as  $\frac{1}{3}x^2 + \frac{1}{3}y^2 - 1\frac{1}{3}x + 2y - 1 = 0$ . Draw the circle on the grid provided. (4 marks)



14. Pipes S and T can fill a tank in 2 hours and 3 hours respectively. Pipe U can empty the full tank in 4 hours. How long will it take to fill the tank with all the pipes running? (2 marks)

15. Table below is part of tax table for annual income for the year 2020.

Taxable income in K£ p.a.	Rate in Kshs. per K£
Under K£4201	2
From K£4201 but under K£8401	3
From K£8401 but under K£12601	4

In the year 2020, the tax on Oyuga's annual income was Ksh.37 000. Calculate Oyuga's annual income in K£. (3 marks)

16. The position vectors of points A, B and C are  $\mathbf{a}$ ,  $\mathbf{b}$  and  $\mathbf{c}$  respectively. Point C divides AB in the ratio 5 : -2. Express  $\mathbf{c}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ . (2 marks)

**SECTION II (50 marks)**

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

17. The Hire Purchase (H.P) price of a public address system was Ksh 448 000. A deposit of Ksh 112 000 was paid followed by 24 equal monthly instalments. The cash price of the public address system was 15% less than the H.P price.

a) Calculate :

(i) The monthly instalment.

(2 marks)

(ii) The cash price.

(2 marks)

- b) A customer decided to buy the system in cash and was allowed an 8% discount on the cash price. He took a bank loan to buy the system in cash. The bank charged compound interest on the loan at rate of 16% p.a. compounded quarterly. The loan was repaid in  $2\frac{1}{2}$  years.

Calculate the amount repaid to the bank by the end of the  $2\frac{1}{2}$  years.

(3 marks)

- c) Express as a percentage of the Hire Purchase price, the difference between the amounts repaid to the bank and the Hire Purchase price.

(3 marks)



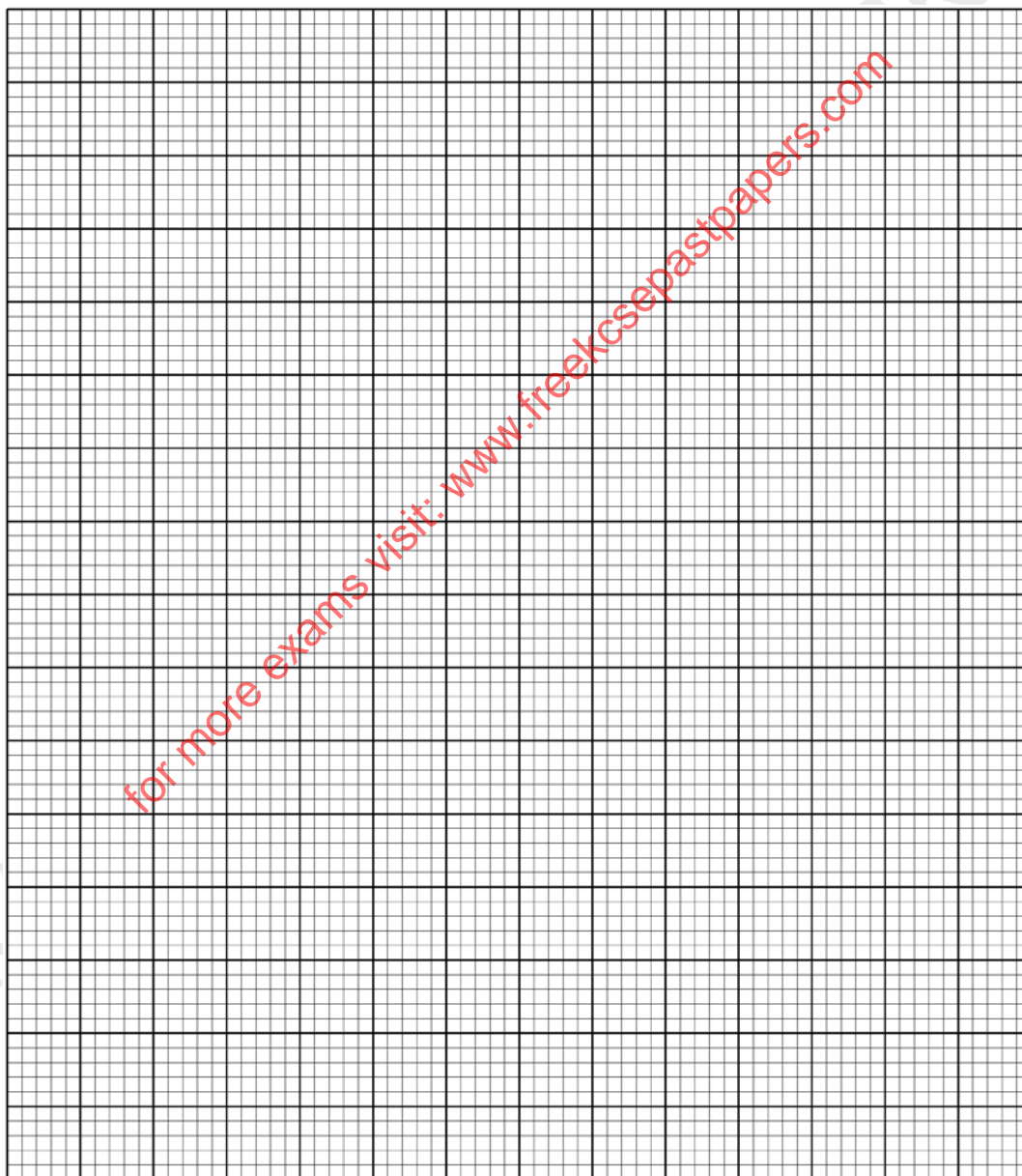
18. (a) Complete the table below for the function  $y = \cos x^\circ$  and  $y = 2 \cos \frac{1}{2}x^\circ$ , for  $0^\circ \leq x \leq 360^\circ$

(2 marks)

$x^\circ$	0	30	60	90	120	150	180	210	240	270	300	330	360
$\cos x^\circ$	1	0.87	0.50			-0.87	-1		-0.50		0.50		1
$2 \cos \frac{1}{2}x^\circ$	2	1.93		1.41		0.52	0		-1		-1.73		-2

(b) On the grid provided, draw the graph of  $y = \cos x^\circ$  and  $y = 2 \cos \frac{1}{2}x^\circ$  using a scale of: 1cm to represent  $30^\circ$  on  $x$ -axis and 4 cm to represent 1 unit on  $y$ -axis

(5 marks)



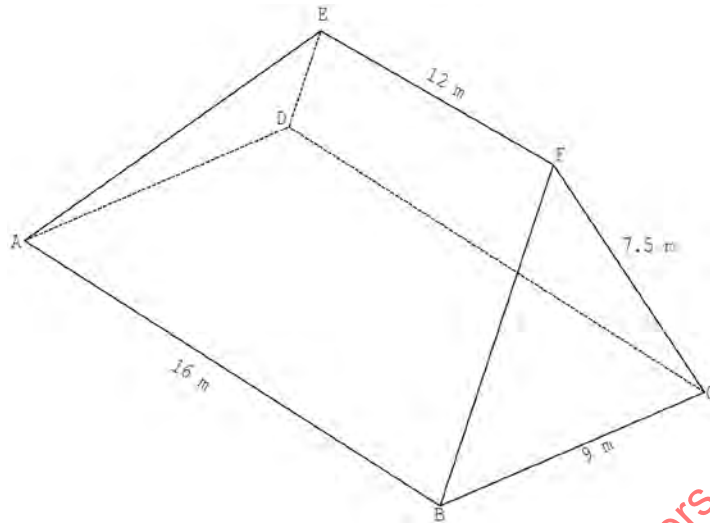
(c) Use your graph to determine:

(i) The period of the function  $y = 2\cos\frac{1}{2}x^0$  (1 mark)

(ii) The transformation that maps the function  $y = \cos x^0$  onto  $y = 2\cos\frac{1}{2}x^0$  (1 mark)

(iii) The values of  $x$  for which  $\cos\frac{1}{2}x^0 - \frac{1}{2}\cos x^0 = 0$  (1 mark)

19. The figure ABCDEF below represents a roof of a house.  $AB = DC = 16$  m,  $BC = AD = 9$  m,  $AE = BF = CF = DE = 7.5$  m and  $EF = 12$  m.



- a) Calculate, correct to 4 significant figures, the perpendicular distance of EF from the plane ABCD. (3 marks)
- b) Calculate, correct to 2 decimal places, the angle between:
- (i) The planes ADE and ABCD. (2 marks)

(ii) The line AE and the plane ABCD.

(2 marks)

(iii) The planes ABFE and DCFE.

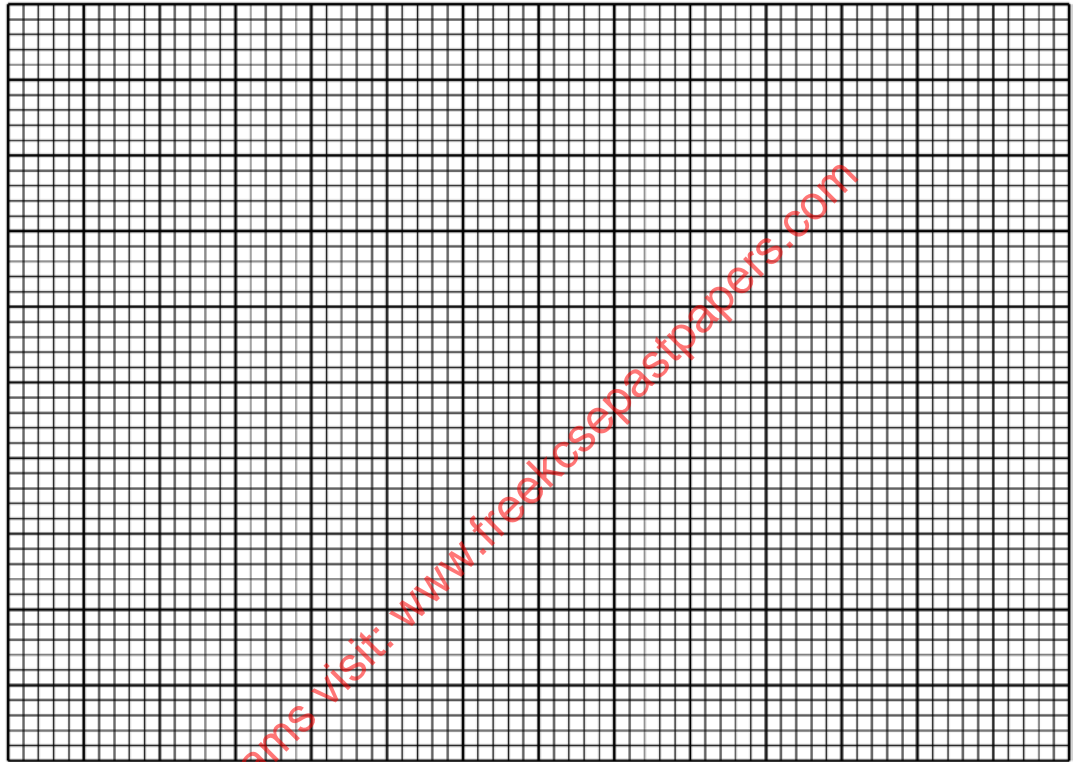
(3 marks)

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20. In an experiment involving two variables  $T$  and  $Q$ , the following results were obtained.

$T$	0.45	1.35	1.80	2.55	3.50	4.50	5.40	6.00
$Q$	8.6	7.2	6.3	5.3	4.0	2.5	1.2	0.3

- a) On the grid provided, plot a graph of  $Q$  against  $T$  and draw the line of best fit for the data. (4 marks)



- b) The variables  $T$  and  $Q$  are connected by the equation  $Q = aT + b$  where  $a$  and  $b$  are constants.

Determine:

- (i) The values of  $a$  and  $b$  (3 marks)

(ii) The equation of the line of best fit.

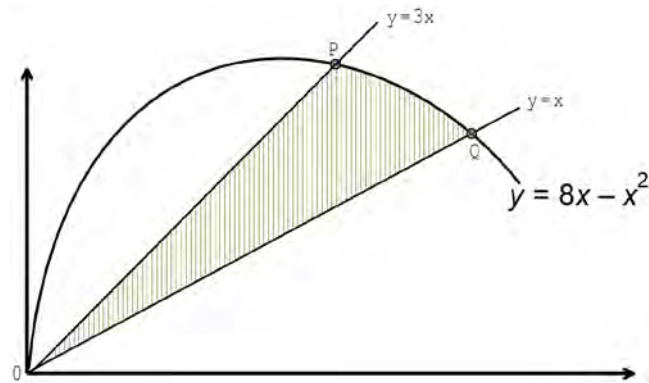
(1 mark)

(iii) The value of  $T$  when  $Q = 0$

(2 marks)

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21. In the figure below, the shaded region is bounded by the lines  $y = 3x$ ,  $y = x$  and the curve  $y = 8x - x^2$ . The two straight lines intersect the curve at points  $P$  and  $Q$ .



- a) Determine the coordinates of point  $P$  and  $Q$ . (2 marks)

- b) Calculate the exact area of the:

- (i) Region bounded by the curve and the line  $y = x$ . (3 marks)

(ii) Region bounded by the curve and the line  $y = 3x$ .

(3 marks)

(iii) Shaded region.

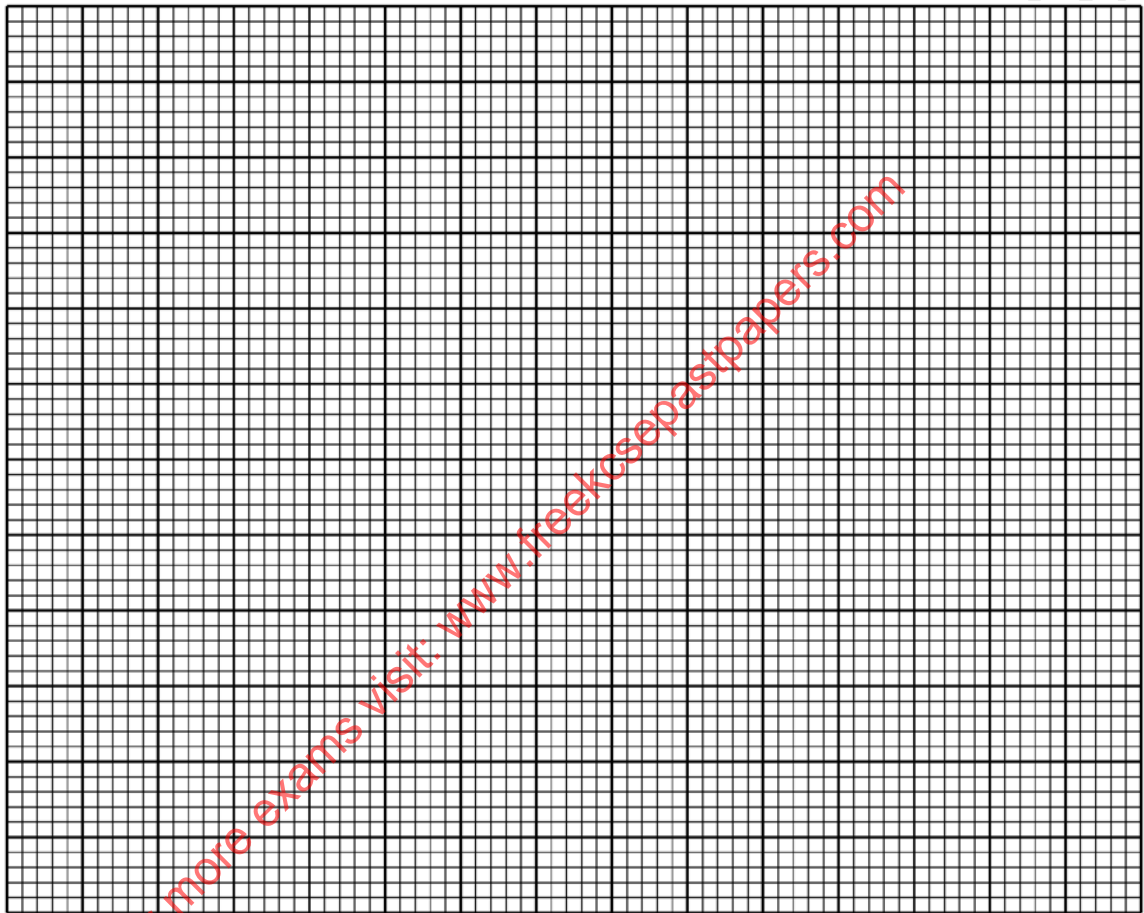
(2 marks)



22. The vertices of a rectangle  $ABCD$  are  $A(-1,1)$ ,  $B(1,1)$ ,  $C(1,4)$  and  $D(-1,4)$ . The vertices of its image under transformation  $T$  are  $A'(1,1)$ ,  $B'(3,1)$ ,  $C'(9,4)$  and  $D'(7,4)$ .

a)

- (i) Draw on the grid provided rectangle  $ABCD$  and its image  $A'B'C'D'$  under the transformation  $T$ . (2 marks)



- (ii) Describe fully the transformation  $T$ . (3 marks)

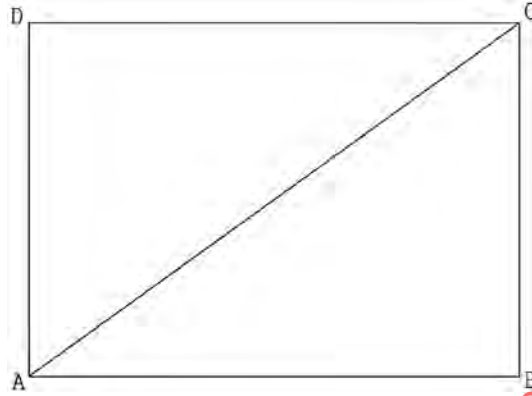
(iii) Determine the matrix of transformation  $T$

(2 marks)

- b) On the same grid as in (a), draw rectangle  $A''B''C''D''$  the image of rectangle  $ABCD$  under a stretch with line  $y = 1$  invariant and stretch factor 2. State the coordinates of  $A''B''C''D''$

(3 marks)

23. The figure below shows a rectangle ABCD with  $AB = 96$  m and diagonal  $AC = 120$  m.



- a) Construct the locus  $L_1$  of points equidistant from A and B and locus  $L_2$  of points equidistant from BC and BA. If  $L_1$  and  $L_2$  meet at N inside the rectangle, locate point N. (3 marks)
- b) A point X is to be located inside the rectangle such that it is nearer B than A and also nearer AB than BC. If it is not greater than 45 m from N shade the region where the points could be located. (4 marks)
- c) Calculate the area of the region X (3 marks)

24.

- a) The first term of an arithmetic progression (AP) is  $-11$ . The sum of the first 8 terms of AP is 52.
- (i) Find the common difference of AP. (2 marks)
- (ii) Given that the sum of the first  $n$  terms of the AP is greater than 920. Find the least value of  $n$ . (3 marks)

- b) The 3<sup>rd</sup>, 7<sup>th</sup>, and 17<sup>th</sup> terms of another AP form the first three terms of a geometric progression (GP). If the common difference of the AP is 3.

Find:

- (i) The first term of GP (3 marks)
- (ii) The sum of the first 7 terms of the GP. (2 marks)