



**Kenya Certificate of Secondary Education**  
**MOI GIRLS HIGH SCHOOL-ELDORET**

**121/2**

**MATHEMATICS-Alt.A**

**Paper 2**

**Oct. 2024 - 2 $\frac{1}{2}$  hours**

**TRIAL EXAMINATION-2024**

Name: .....Index Number:.....

Student's Signature: ..... Date: .....ADM NO .....

**Instructions to candidates**

- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) This paper consists of **two** sections: **Section I** and **Section II**.
- (d) Answer **all** questions in **Section I** and only five questions in **Section II**.
- (e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided 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 16 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.**
- (j) **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. The cash price of a flat screen television set (TV) is Ksh. 38,000. Caleb opts to buy the TV on hire purchase terms by making a down payment of Ksh. 9,000 and 18 monthly instalments of Ksh. 2,000 each. Determine, correct to **one** decimal place, the rate of compound interest charged per month. (3 marks)
  
2. P varies directly as the square of Q and inversely as R. If Q increases by 5% and R decreases by 10% , find the percentage change in P. (3 marks)
  
3. Determine the period, amplitude and the phase angle of  $y = \frac{3}{2} \cos(3x - 48)$  (3 marks)
  
4. Solve the equation  $\log 3 + \log(4x + 4) = 1 + \log(2x - 2)$  (3 marks)

5. Solve the equation  $2 \sin^2 x - 1 = \cos^2 x + \sin x$  for  $0^\circ \leq x \leq 360^\circ$ . (4 marks)

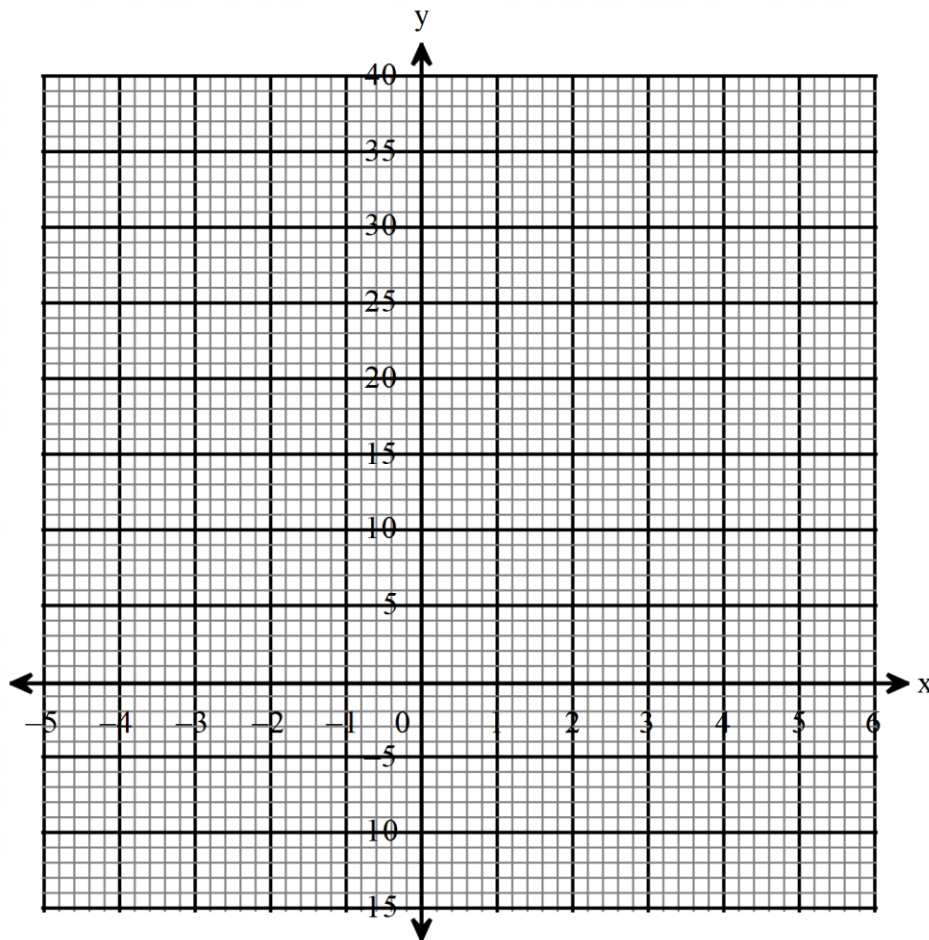
6. The position vectors of points A, B and C are  $\mathbf{OA} = 2\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ ,  $\mathbf{OB} = 6\mathbf{i} - 3\mathbf{j} + 9\mathbf{k}$  and  $\mathbf{OC} = 18\mathbf{i} - 9\mathbf{j} + 27\mathbf{k}$ . Show that points A, B and C are collinear. (3 marks)

7. Given that  $(2x - 1)$ ,  $(3x - 3)$  and  $(2x + 6)$  are consecutive terms of a geometric progression, find the possible value(s) of  $x$  and the common ratio of the progression. (4 marks)

8. (a) Complete the table below for  $y = x^3 - 2x^2 - 9x + 8$  in the range  $-3 \leq x \leq 5$ . (1 mark)

$x$	-3	-2	-1	0	1	2	3	4	5
$y$	-10		14	8		-10			38

- (b) On the grid provided, draw the graph of  $y = x^3 - 2x^2 - 9x + 8$  for  $-3 \leq x \leq 5$ . (2 marks)



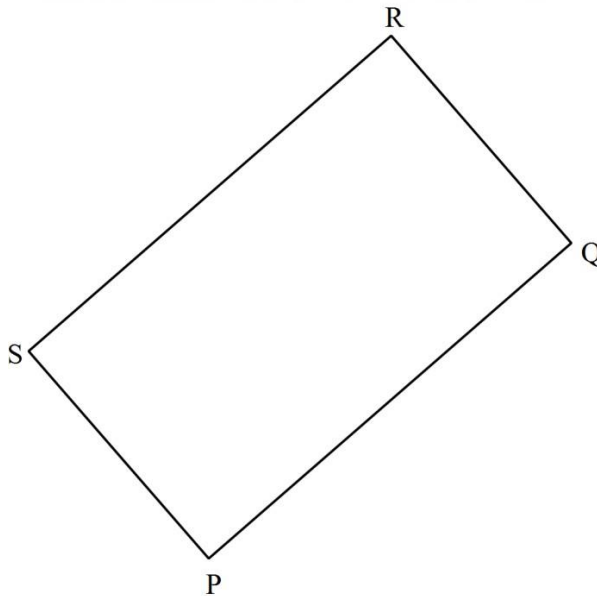
- (b) Use the graph to determine the rate of change at  $x = -2$  (1 mark)

9. Make  $M$  the subject of the formula;  $S = P \sqrt{\frac{M}{M-1}}$  (3 marks)

10. (a) Expand the expression in increasing powers of  $x$ ,  $(1 + x)^5$  (1 mark)

(b) Use the first three terms of the expansion in part (a) above to estimate the value of  $(0.98)^5$ . (2 marks)

11. The figure below shows a rectangular grazing field PQRS



A water trough T is to be constructed within the field. The trough must be nearer to the edge PQ than edge SR. Angle STR must be greater than  $90^\circ$ . Shade the region T within which the water trough may be constructed. (3 marks)

12. The probability of Sally passing her driving test is 0.7. The probability of both Sally and Laura passing the driving test is 0.56. Determine:

(a) The probability of Laura passing her driving test. (1 mark)

(b) The probability of both ladies failing the test. (1 mark)

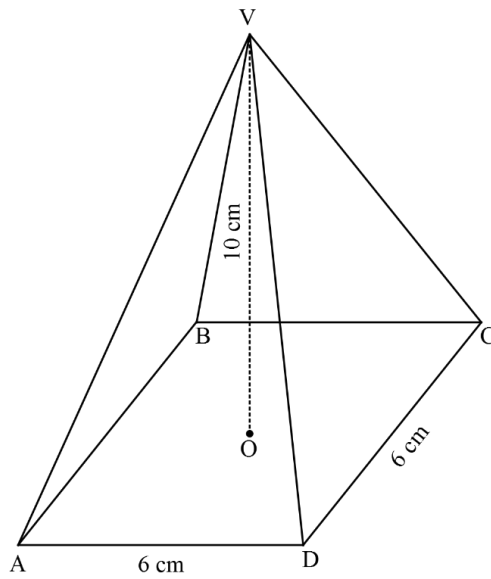
13. A factory employs unskilled workers who earn sh. 6,000 per month and skilled workers who earn sh. 15,000 per month. The monthly wage bills must not exceed sh. 150,000. The machines require a maximum of 50 operators. Labour regulations demand that the number of skilled workers should be at most half the number of unskilled workers. If  $x$  is the number of unskilled workers and  $y$  the number of skilled workers, write down the inequalities that satisfy the above situation. (3 marks)

14. An object of area  $12 \text{ cm}^2$  is mapped onto an image of area  $144 \text{ cm}^2$  by the transformation Matrix

$$M = \begin{pmatrix} x & 11 \\ -3 & x - 10 \end{pmatrix}. \text{ Find the value of } x. \quad (3 \text{ marks})$$

15. Two lines with equations  $2x + 3y = 4$  and  $x + 2y = 1$  intersect at the centre of a circle. Given that the area of the circle is  $132 \text{ cm}^2$ , find the equation of the circle. (3marks)

16. The figure below is a square based pyramid  $ABCDV$  with  $AD = DC = 6$  cm and height  $OV = 10$  cm.



Calculate correct to one decimal place, the angle between edge  $AV$  and the plane  $ABCD$ .  
(3 marks)

**SECTION II (50 marks)**

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

17. A farmer has two tractors, A and B. The tractors working together can plough a farm in  $3\frac{1}{3}$  hours.

One day the tractors started to plough the farm together and after 1 hour 10 minutes, tractor B broke down but A continued alone and completed the job after a further 6 hours 30 minutes.

Find;

(a) The fraction of the job done by the tractors working together for one hour. (2 marks)

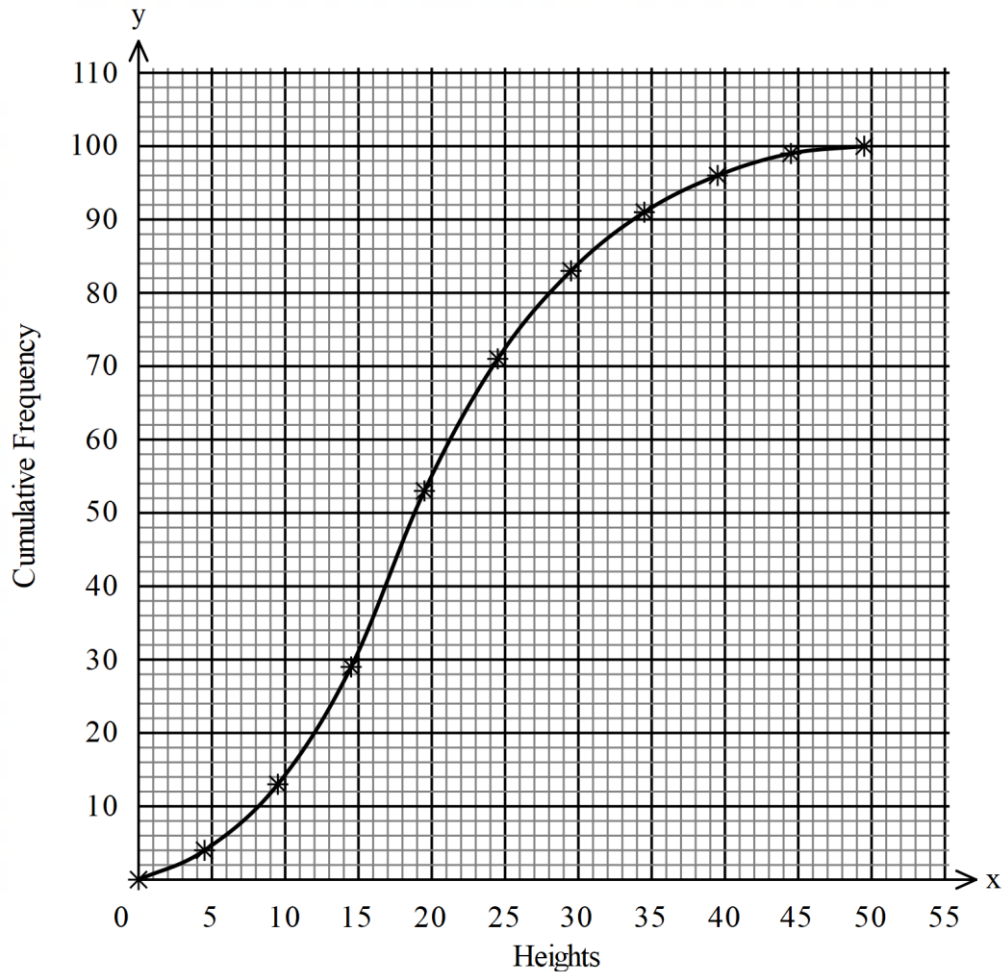
(b) The fraction of the job done by tractor A after tractor B broke down. (3 marks)

(c) The time each tractor working alone would have taken to plough the farm. (3 marks)

(d) If the two tractors hired out would earn the farmer a total of ksh. 90 000 per day. Calculate how much money the farmer earned through tractor A if amount paid is directly proportional to the work done. (2 marks)



18. The heights of 100 maize plants were measured to the nearest centimeter and the results recorded and presented on the cumulative frequency curve drawn below.



Use the graph to determine;

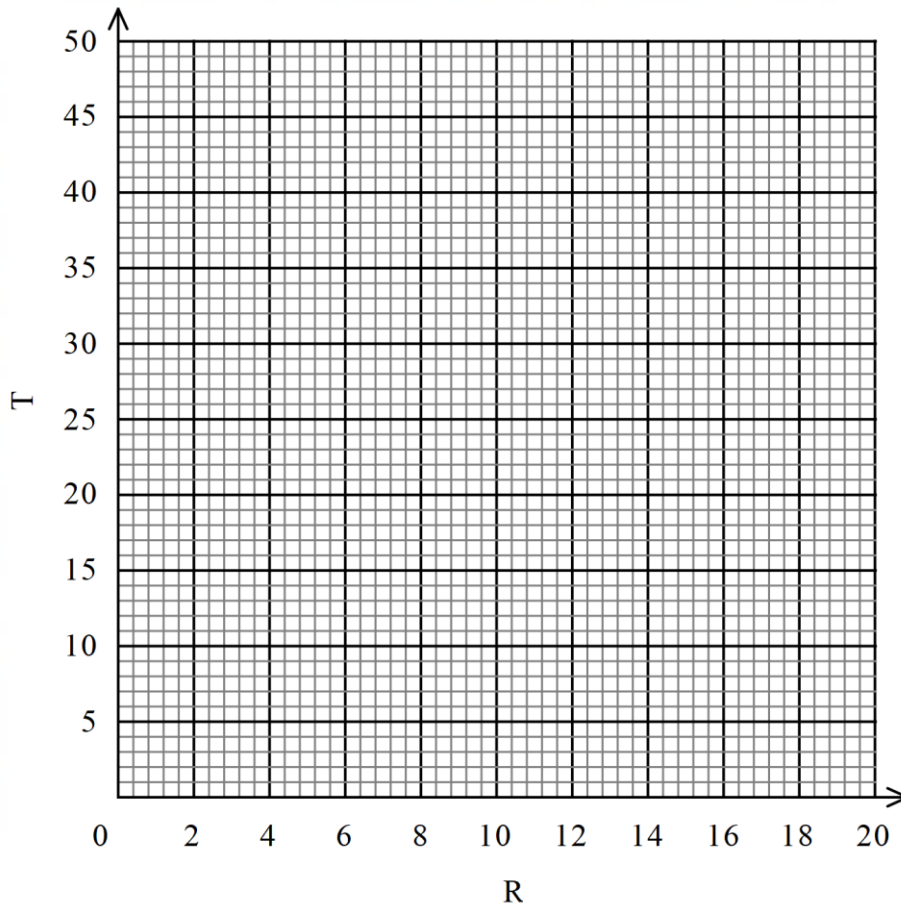
- (i) The median height. (1 mark)
  
- (ii) The quartile deviation. (4 marks)
  
- (iii) 75<sup>th</sup> percentile. (1 mark)
  
- (iv) The percentage number of maize plants whose heights are at least 23cm. (4 marks)

19. In an experiment involving two variables T and R, the following results were obtained.

T	10	15	20	25	30	35
R	15	14	13	12.5	10.5	10

(a) On the grid provided, draw the **line of best fit** for the data.

(2 marks)



(b) The variables T and R are connected by the equation  $T = mR + k$  where m and k are constants.

Determine;

(i) The values of m and k.

(3 marks)

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

(1 mark)

(c) Use the equation of the **line of best fit** obtained in (b)(ii) above to determine;

(i) The value of T when R=10

(2 marks)

(ii) The value of R when T=30

(2 marks)

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

Monthly taxable income in Kenya shillings	Tax rates in each shilling(%)
0-12298	10
12299-23885	15
23886-35472	20
35473 and above	25

In that year, an employee's monthly earnings were as follows:

Basic salary	Ksh.18000
House allowance	Ksh.5000
Medical allowance	Ksh.2000

An employee was entitled to a monthly tax relief of ksh.1408

(a) Calculate the tax charged on his monthly earnings.

(6 marks)

(b) Apart from income tax, the following monthly deductions were made;

Health insurance fund	ksh 500
Education Insurance	ksh 800
Widow and children pension scheme	ksh 500

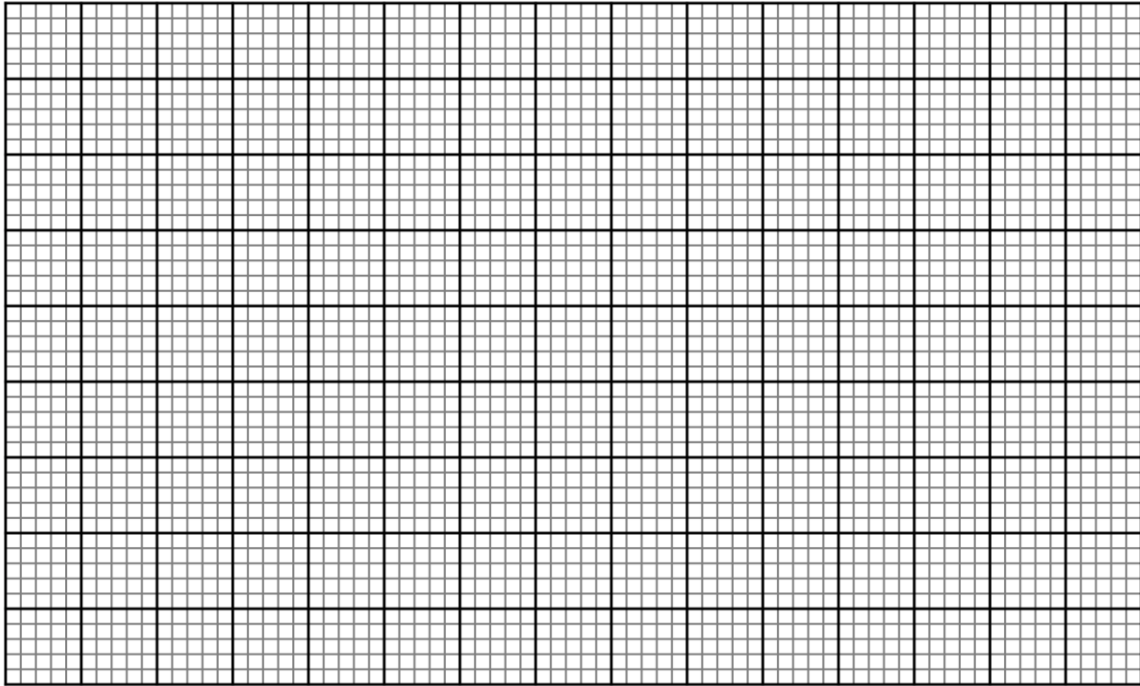
Calculate his monthly net income from his employment.

(4 marks)

21. (a) Complete the table below for the function of  $y = 3 \sin(2x + 30^\circ)$  and  $y = \cos(x - 60^\circ)$  for  $0^\circ \leq x \leq 360^\circ$ . (2 marks)

x	$0^\circ$	$30^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$150^\circ$	$180^\circ$	$210^\circ$	$240^\circ$	$270^\circ$	$300^\circ$	$330^\circ$	$360^\circ$
$3 \sin(2x + 30^\circ)$	1.50	3.00	1.50		-3.00	-1.50		3.00		-1.80	-3.00		1.50
$\cos(x - 60)$	0.50		1.00	0.87	0.50	0.00		-0.87	-1.00		-0.50	0.00	0.50

- (b) Draw the graph of the functions;  $y = 3 \sin(2x + 30^\circ)$  and  $y = \cos(x - 60^\circ)$  on the same axes. (5 marks)



- (c) Use your graph to solve the following equations;
- (i)  $3 \sin(2x + 30^\circ) - \cos(x - 60^\circ) = 0$ . (1 mark)
- (ii)  $3 \sin(2x + 30^\circ) = 0.8$ . (1 mark)
- (d) Determine the periodic angle of the function  $y = 3 \sin(2x + 30^\circ)$ . (1 mark)

22. A particle was moving along a straight line. The acceleration of the particle after  $t$  seconds was given by  $(2t - 9) \text{ ms}^{-2}$ . The initial velocity of the particle was  $18 \text{ ms}^{-1}$ .

(a) Determine the values of  $t$  when the particle is momentarily at rest. (5 marks)

(b) Find the distance covered by the particle between  $t = 2$  second and  $t = 5$  seconds. (5 marks)

23. The positions of two towns A and B are  $(50^\circ\text{N}, 45^\circ\text{W})$  and  $(50^\circ\text{N}, K^\circ\text{W})$  respectively. It takes a plane 5 hours to travel from A to B at an average speed of 800 knots. The same plane takes  $1\frac{1}{2}$  hours to travel from B to another town C at the same average speed. Given that C is to the north of B.

(a) Calculate to the nearest degree;

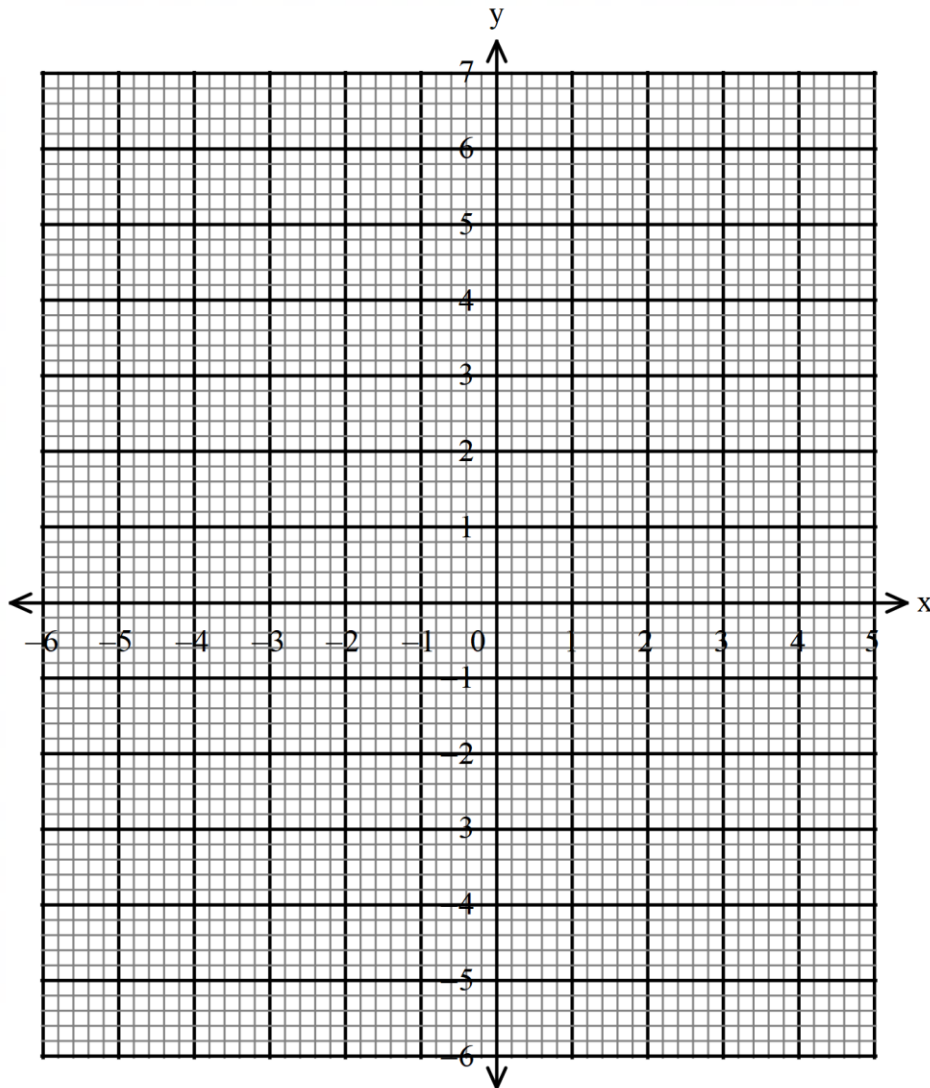
(i) The value of K. (4 marks)

(ii) The position of C. (3 marks)

(b) If the plane started from A at 9:00 a. m. and flew to C through B, find the local time at C when the plane arrived there. (3 marks)

24. The vertices of a triangle PQR are  $P(-3, -2)$ ,  $Q(0, -1)$  and  $R(1, 2)$ . The vertices of its image under a transformation M are  $P^1(-2, 6)$ ,  $Q^1(-1, 0)$  and  $R^1(2, -2)$ .

(a) (i) On the grid provided, draw the triangle PQR and its image  $P^1Q^1R^1$  under M. (2 marks)



(i) Describe fully the transformation M.

(3 marks)

(iii) Determine the matrix of transformation.

(2 marks)

(b) On the same grid in (a), draw the image of triangle PQR under a shear with line  $x = -2$  invariant and  $P(-3, -2)$  is mapped onto  $P^{11}(-3, 0)$ . (3 marks)