

K.C.S.E. MATHEMATICS PAPER 121/2, 2002

SECTION I

Answer all the questions in this section

1. Determine the inverse, T^{-1} of the matrix $T = \begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$

Hence find the coordinates to the point at which the two lines $x + 2y = 7$ and $x - y = 1$ intersect. (4 marks)

2. A trader sells a bag of beans for sh. 2,100 and that of maize for sh 1,200. He mixed beans and maize in ratio 3:2. Find how much the trader should sell a bag of the mixture to realise the same profit. (3 marks)

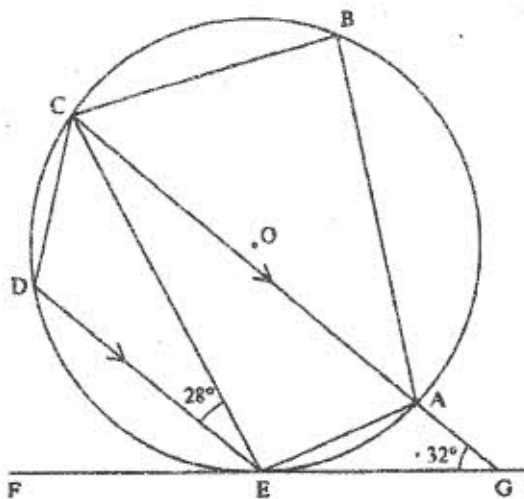
3. The sides of a triangle were measured and recorded as 8cm, 8cm and 15cm. Calculate the percentage error in perimeter, correct to 2 decimal places. (3 marks)

4. a) Expand $(a - b)^6$. (1 mark)

b) Use the first three terms of the expansion in (a) to find the appropriate value of $(1.98)^6$. (3 marks)

5. The coordinates of points O, P, Q and R are (0, 0), (3, 4), (11, 6) and (8, 2) respectively. A point T is such that the vectors OT, QP and QR satisfy the vector equation $OT = QP + \frac{1}{2}QR$. Find the coordinates of T. (3 marks)

6. The diagram below shows a circle ABCDE. The line FEG is a tangent to the circle at point E. Line DE is parallel to CG, $\angle DEC = 28^\circ$ and $\angle AGE = 32^\circ$.



Calculate:

- a) $\angle AEG$
b) $\angle ABC$

(2 marks)

(2 marks)

7. Each month, 40 months, Amina deposited some money in a saving scheme. In the first month she deposited Sh 500. Thereafter she increased her deposits by Sh 50 every month.

Calculate the:

- a) last amount deposited by Amina

(2 marks)

- b) total amount Amina had saved in the 40 months.

(2 marks)

8. The equation of a circle is given by $x^2 + 4x + y^2 - 5 = 0$.
Find the radius and centre of the circle. (4 marks)

9. Make y the subject of the formula:

$$p = \frac{xy}{x-y}$$

(3 marks)

10. The position vectors of points X and Y are $x = 2i + j - 3k$ and $y = 3i + 2j - 2k$ respectively.
Find XY (2 marks)

11. The average rate of depreciation in value of a water pump is 9% per annum. After three complete years its value was sh 150,700. Find its value at the start of the three year period. (4 marks)

12. Chords XY and RQ of a circle intersect at a point M inside the circle. Given that $MX = 8\text{cm}$, $XY = 14\text{cm}$ and $MP = 4\text{cm}$, calculate the length of MQ (2 marks)

13. Given that $\sin \alpha = \frac{1}{\sqrt{5}}$, where α is an acute angle, find, without using mathematical tables:

a) $\cos \alpha$ in the form of $a\sqrt{b}$ where a and b are rational numbers (2 marks)

b) $\tan(90^\circ - \alpha)$ (1 mark)

14. A quantity P is partly constant and partly varies inversely as a quantity q. Given that $P = 10$, when $q = 1.5$ and $P = 20$ when $q = 1.25$, find the value of P when $q = 0.5$ (4 marks)

15. The table below shows the weight and price relatives of four items in a given period

Item	Weight	Price Relative
Maize meal	6	220
Meat	3	120
Sugar	4	180
Cooking fats	2	150

Computer the cost of living index for the given items (4 marks)

16. Give the curve $y = 2x^3 + \frac{1}{2}x^2 - 4x + 1$ find the:

i) gradient of the curve at $\left(1, -\frac{1}{2}\right)$

ii) equation of the tangent to the curve at $\left(1, -\frac{1}{2}\right)$ (4 marks)

SECTION II

Answer any six questions from this section

17. The table below shows Kenya Tax Rates in a certain year:

Income (K£ per annum)	Tax Rates (sh per £)
1 - 4,512	2
4,513 - 9,024	3
9,025 - 13,536	4
13,537 - 18,048	5
18,049 - 22,560	6
Over 22,560	6.5

In that year Muhando earned a salary of Kshs 16,510 per month. He was entitled to a monthly tax relief of Ksh 960.

Calculate:

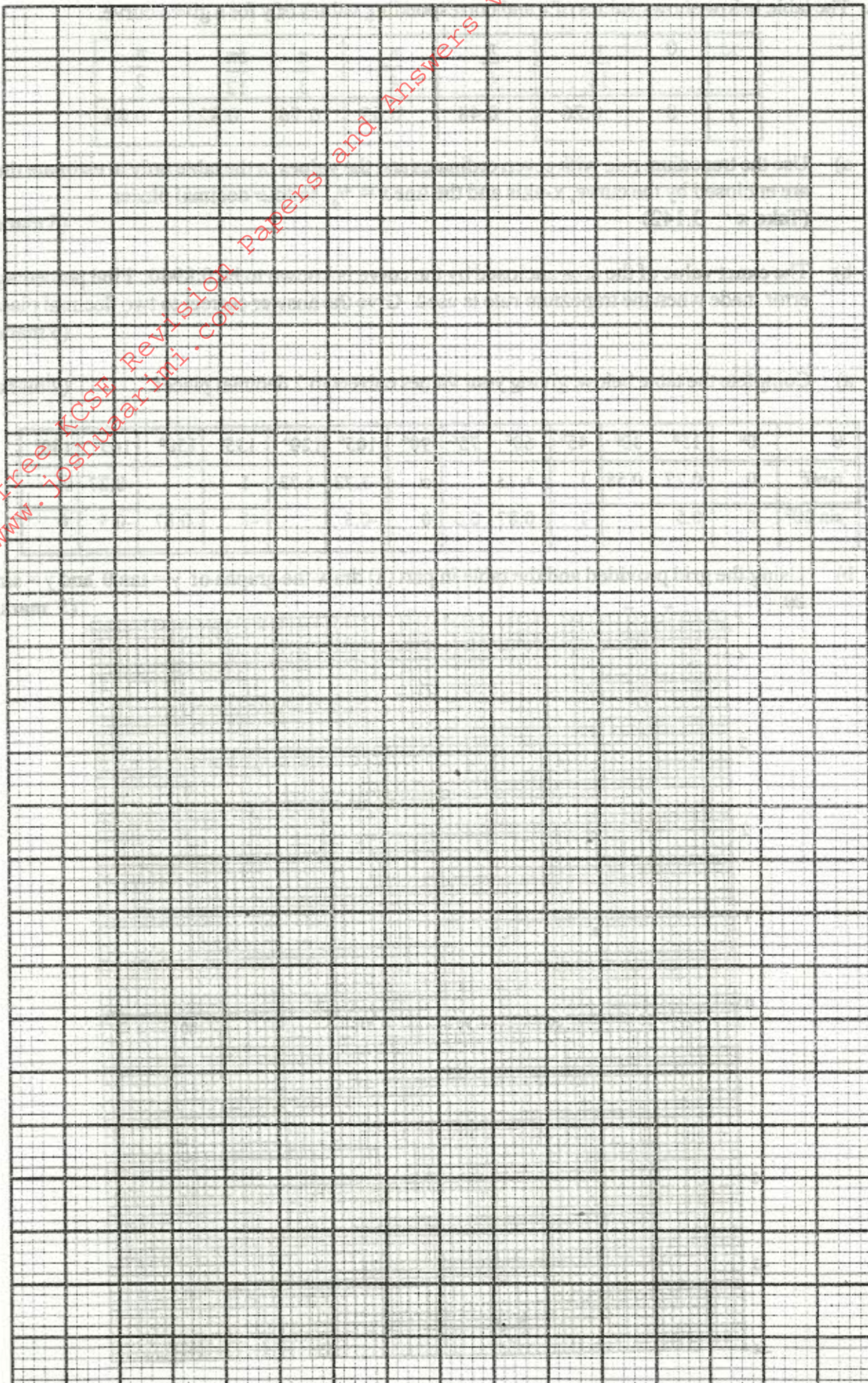
- Muhando's annual salary in K£ (2 marks)
- The monthly tax paid by Muhando in Ksh. (6 marks)

18. The following distribution shows the masses to the nearest kilogram of 65 animals in a certain farm.

Mass (kg)	26-30	31-35	35-40	41-45	46-50	51-55
Frequency	9	13	20	15	6	2

- On the grid provided draw the cumulative frequency curve for the given information. (3 marks)
- Use the graph to find the:
 - median mass
 - interquartile range
 - percentage of animals whose mass is at least 42 kg. (5 marks)

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19. The table below shows values of x and corresponding values of y for a given curve.

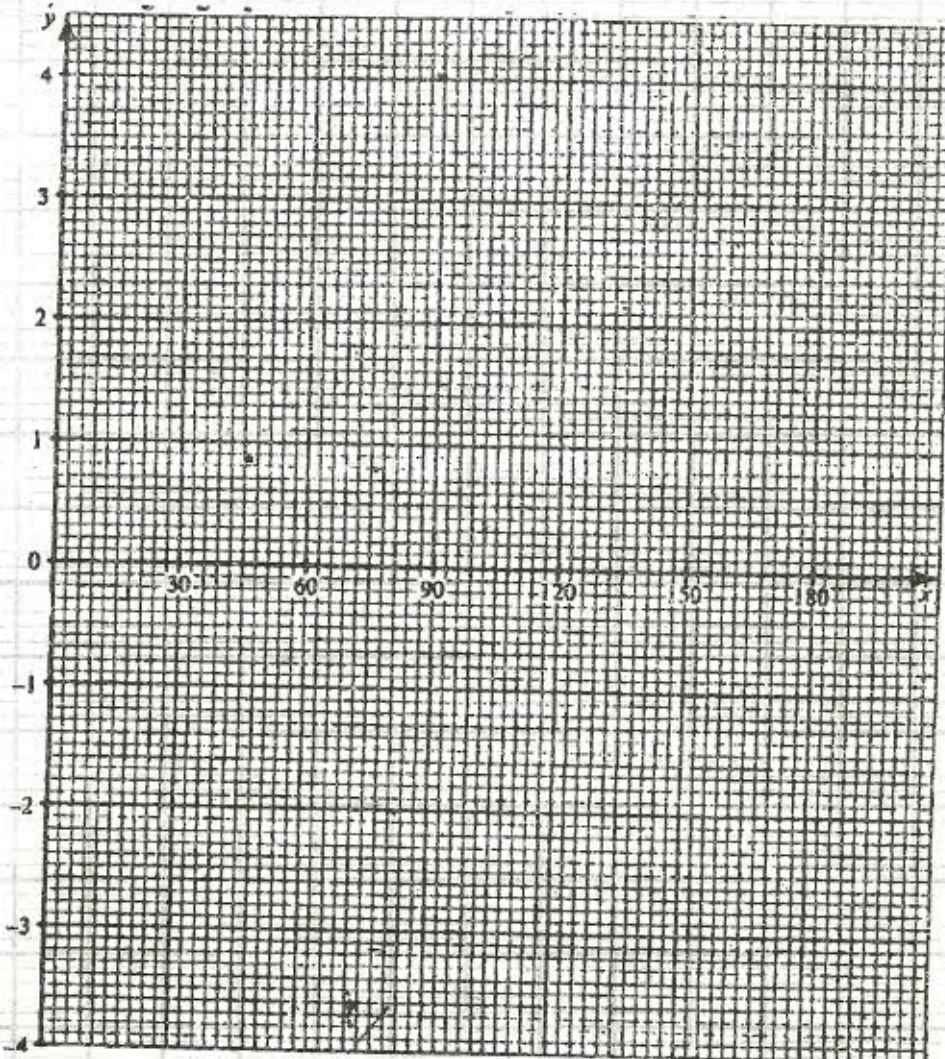
x	0	$\frac{\pi}{12}$	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{5\pi}{12}$	$\frac{\pi}{2}$
y	0	0.26	0.48	0.65	0.76	0.82	0.84

- a) Use the trapezium rule with seven ordinates and the values in the table only to estimate the area enclosed by the curve, x -axis and the line $x = \frac{\pi}{2}$ to four decimal places
(Take $\pi = 3.142$) (5 marks)
- b) The exact value of the area enclosed by the curve is known to be 0.8940. Find percentage error made when the trapezium rule is used. Give the answer correct to two decimal places. (3 marks)

20. a) Complete the table below, giving your values correct to 2 decimal places. (2 marks)

θ	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
$\tan \theta^\circ$	0	0.27	0.58	1	1.73		α	-3.73	-1.73	-1		-0.27	0
$\sin 2\theta^\circ$	0	0.5		1	0.87	0.5	0	-0.5		-1	-0.87	-0.5	0

b) Using the grid provided and the table in part (a) draw the graphs of $y = \tan \theta$ and $y = \sin 2\theta$. (5 marks)



c) Using your graphs, determine the range of values for which $\tan \theta > \sin 2\theta$ for $0^\circ \leq \theta \leq 90^\circ$ (1 mark)

21. The displacement s metres of a particle moving along a straight line after t seconds is given by

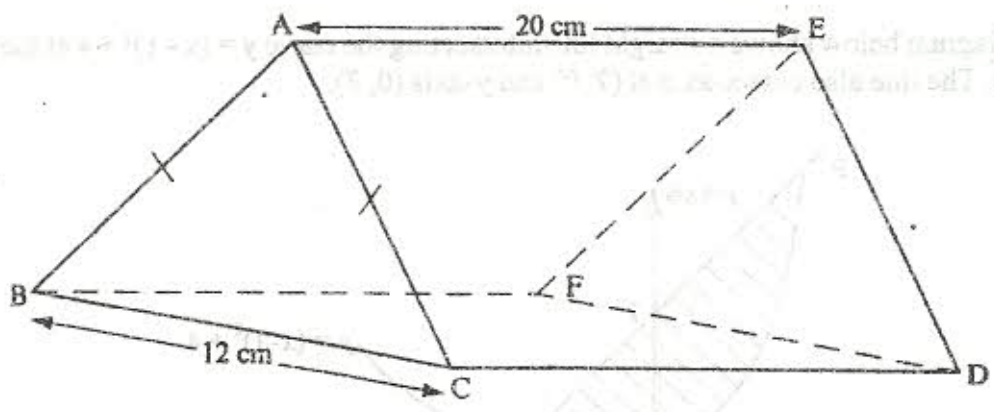
$$s = 3t + \frac{3}{2}t^2 - 2t^3$$

- a) Find its initial acceleration. (3 marks)
- b) Calculate:
 - i) the time when the particle was momentarily at rest (2 marks)
 - ii) its displacement by the time it comes to rest momentarily. (1 mark)
- c) Calculate the maximum speed attained. (2 marks)

22. A house is to be sold either on a cash basis or through a loan. The cash price is sh 750,000. The loan conditions are as follows: there is to be down payment of 10% of the cash price and the rest of the money is to be paid through a loan at 10% per annum compound interest.

- A customer decided to buy the house through a loan
- a) i) Calculate the amount of money loaned to the customer (2 marks)
 - ii) The customer paid the loan in 3 years. Calculate the total amount paid for the house (3 marks)
 - b) Find how long the customer would have taken to fully pay for the house if she paid a total of sh 891,750 (3 marks)

23. The figure below represents a right prism whose triangular faces are isosceles. The base and height of each triangular face are 12cm and 8cm respectively. The length of the prism is 20cm



- Calculate the:
- a) length CE (3 marks)
 - b) angle between
 - i) the line CE and the plane BCDF (3 marks)
 - ii) the plane EBC and the base BCDF (2 marks)

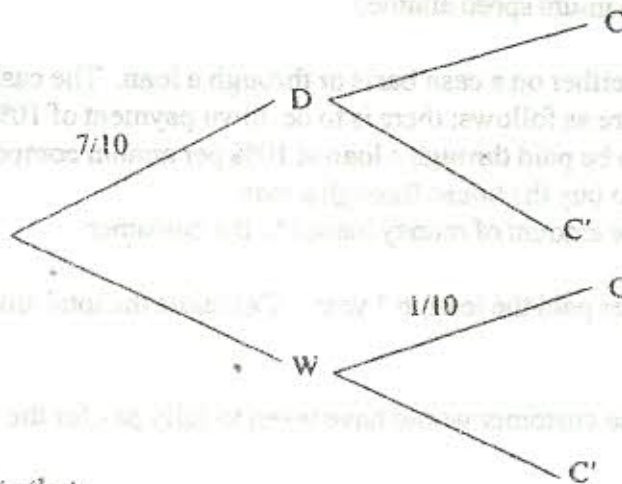
24. a) An unbiased coin with two faces, head (H) and tail (T), is tossed three times. List all the possible outcomes

Hence determine the probability of getting:

i) at least two heads

ii) only one tail

- b) During a certain motor rally it is predicted that the weather will be either dry (D) or wet (W). The probability that the weather will be dry is estimated to be $\frac{7}{10}$. The probability for a driver to complete (C) the rally during the dry weather is estimated to be $\frac{5}{6}$. The probability for a driver to complete the rally during wet weather is estimated to be $\frac{1}{10}$. Complete the probability tree diagram given below.



What is the probability that:

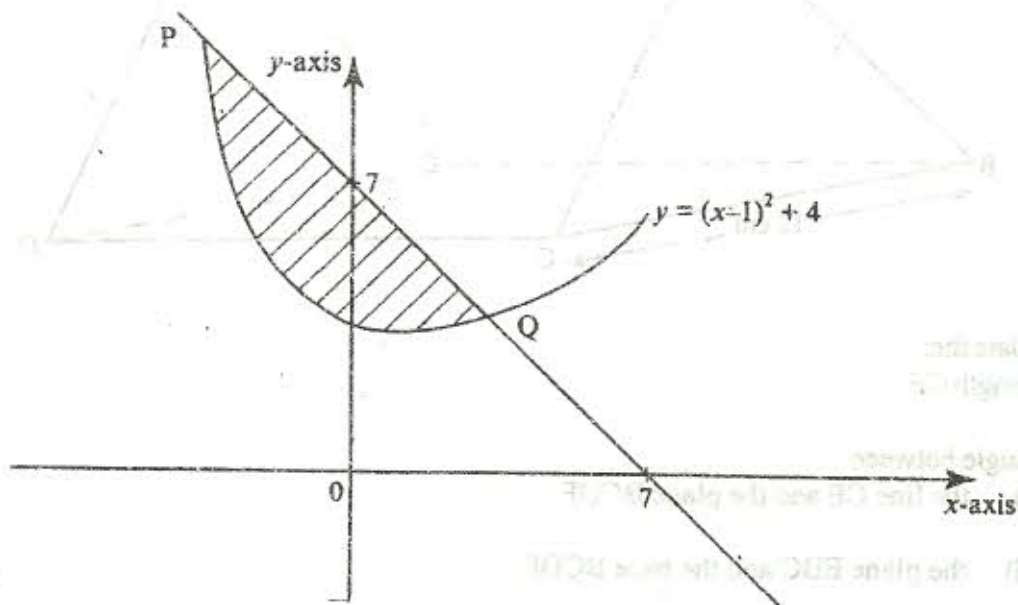
i) the driver completes the rally?

(2 marks)

ii) the weather was wet and the driver did not complete the rally?

(1 mark)

25. The diagram below shows a straight line intersecting the curve $y = (x - 1)^2 + 4$ at the points P and Q. The line also cuts x-axis at (7, 0) and y-axis (0, 7).



- a) Find the equation of the straight line in the form $y = mx + c$ (2 marks)
- b) Find the coordinates of P and Q (3 marks)
- c) Calculate the area of the shaded region (3 marks)

26. In this question use a ruler and a pair of compasses

- a) Line PQ drawn below is part of a triangle PQR. Construct the triangle PQR in which $\angle QPR = 30^\circ$ and line PR = 8cm.



- b) On the same diagram construct triangle PRS such that point S and Q are on opposite sides of PR, PS = SR and QS = 5cm
- c) A point T is on a line passing through R and parallel to QS. If $\angle QTS = 90^\circ$, locate two possible positions of T and label them T_1 and T_2 . Measure the length of T_1T_2 (4 marks)

27. A triangle T whose vertices are A(2, 3), B(5, 3) and C(4, 1) is mapped onto triangle T_1 whose vertices are $A_1(-4, 3)$, $B_1(-1, 3)$ and $C_1(x, y)$ by a transformation

$$M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

- a) Find the:
- matrix M of the transformation (4 marks)
 - coordinates of C_1 (2 marks)
- b) Triangle T_2 is the image of triangle T_1 under a reflection in the line $y = x$. Find a single matrix that maps T onto T_2 (2 marks)