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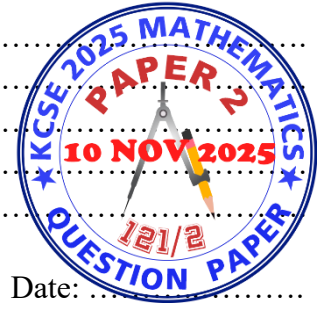
CANDIDATE NAME:

INDEX NUMBER:

CENTRE CODE:

CENTRE NAME:

RANDOM NUMBER:



121/2

Candidate's signature:

Date:

Random Number: 121220251011

KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

121/2



MATHEMATICS Alt. A

Paper 2

Nov. 2025 – 2½ hours

Candidate's signature: Date:

Instructions to candidates

- (a) Confirm that this question paper has your name, name of your school and the correct index number.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) The paper consists of **two** sections. **Section I** and **Section II**.
- (d) Answer **ALL** the questions in Section I and any **FIVE** questions in Section II.
- (e) **Show all the steps in your calculations, giving your answer 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 19 printed pages.*
- (i) *Candidates must check the question paper to ascertain that all 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



SECTION I (50 marks)

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

1. The first three terms of an arithmetic progression (AP) are $8 - x$, $2x$ and $3x + 2$. Find the value of x and hence the common difference of the AP. (3 marks)

2. The temperature in a room was measured as 20°C in the morning and 25°C in the afternoon. The difference in the temperature of the room was calculated. Determine the maximum possible error in the calculation. (3 marks)

3. Find the value of a and b for which $\frac{7\sqrt{2}}{5-3\sqrt{2}} = a + b\sqrt{2}$. (3 marks)

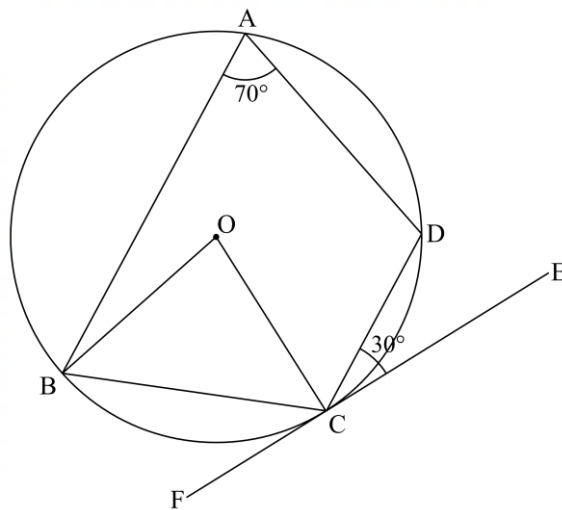


4.

(a) Expand and simplify the expression $\left(2 + \frac{1}{2x}\right)^5$. (2 marks)

(b) Use the first four terms of the expansion in (a) to estimate the value of $(2.05)^5$. (2 marks)

5. In the following figure, A, B, C and D are points on the circumference of a circle centre, O. Line FE is a tangent to the circle at point C. Angle $DCE = 30^\circ$ and $\angle BAD = 70^\circ$.

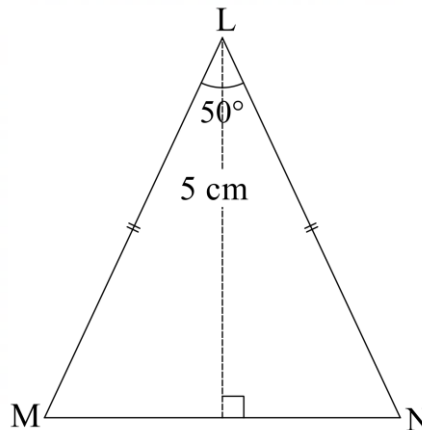


Giving reasons at each stage, determine the size of the acute angle BOC. (3 marks)



6. Two quantities y and x are such that y varies directly as the square of $(x+1)$. Given that $y = 200$ when $x = 4$, determine the equation connecting the two quantities.
(3 marks)

7. The following figure shows an isosceles triangle MLN . The height of the triangle is 5 cm and $\angle MLN = 50^\circ$.



On the figure, use a ruler and a pair of compasses only to construct:

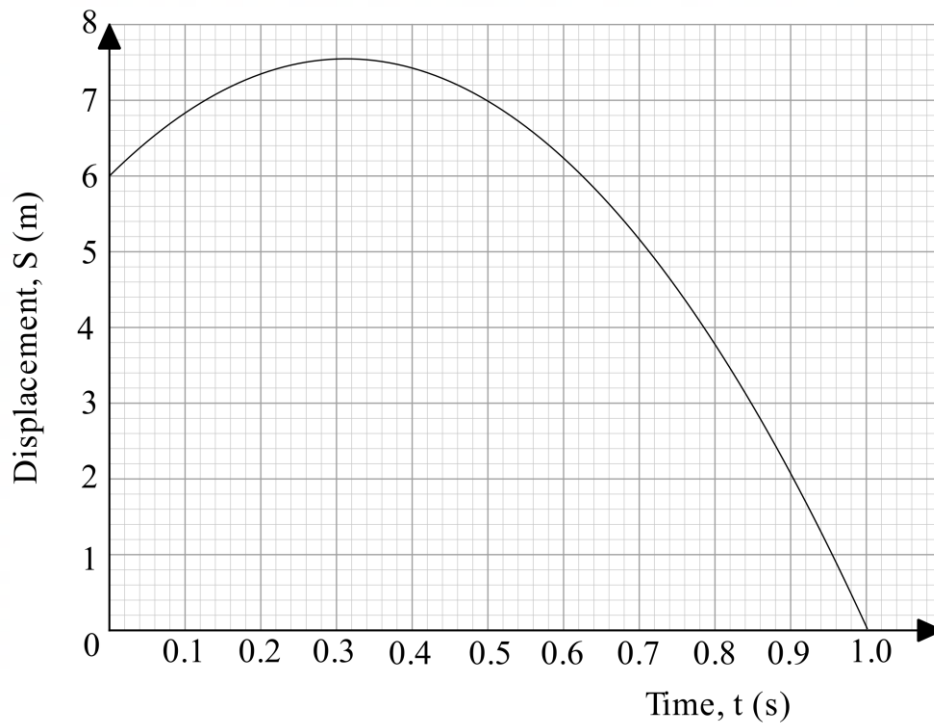
- (a) The locus of point P such that $\angle MPN = 50^\circ$. (2 marks)
- (b) Locate point Q such that the area of $\triangle MQN$ is half that of $\triangle MLN$ and $\angle MQN = 50^\circ$. (2 marks)



8. A point U is 9 000 nm to the East of Point T($0^\circ, 50^\circ\text{W}$). Find the longitude at U.

(3 marks)

9. The following graph shows the displacement S metres of a moving particle from a point O after time, t seconds ($0 \leq t \leq 1$).



Use the graph to determine the rate of change of displacement S at time $t = 0.5$ seconds.

(3 marks)



10. The ages of 32 residents at a home for the elderly people are presented in the following frequency distribution table.

Age (years)	70 – 74	75 – 79	80 – 84	85 – 89	90 – 94	95 – 99
No. of residents	5	6	7	8	4	2

Calculate the upper quartile (Q_3) age of the residents. (3 marks)

11. A circle centre $(-2,3)$ and radius 5 units is drawn on a Cartesian plane. Determine the x intercepts of the circle. (3 marks)

12. An investor deposited Ksh. 20 000 in an account that paid compound interest at a rate of 2.5% every 6 months. At the end of the investment period, the interest earned was Ksh. 5 600. Determine the duration in years of the investment period. (3 marks)



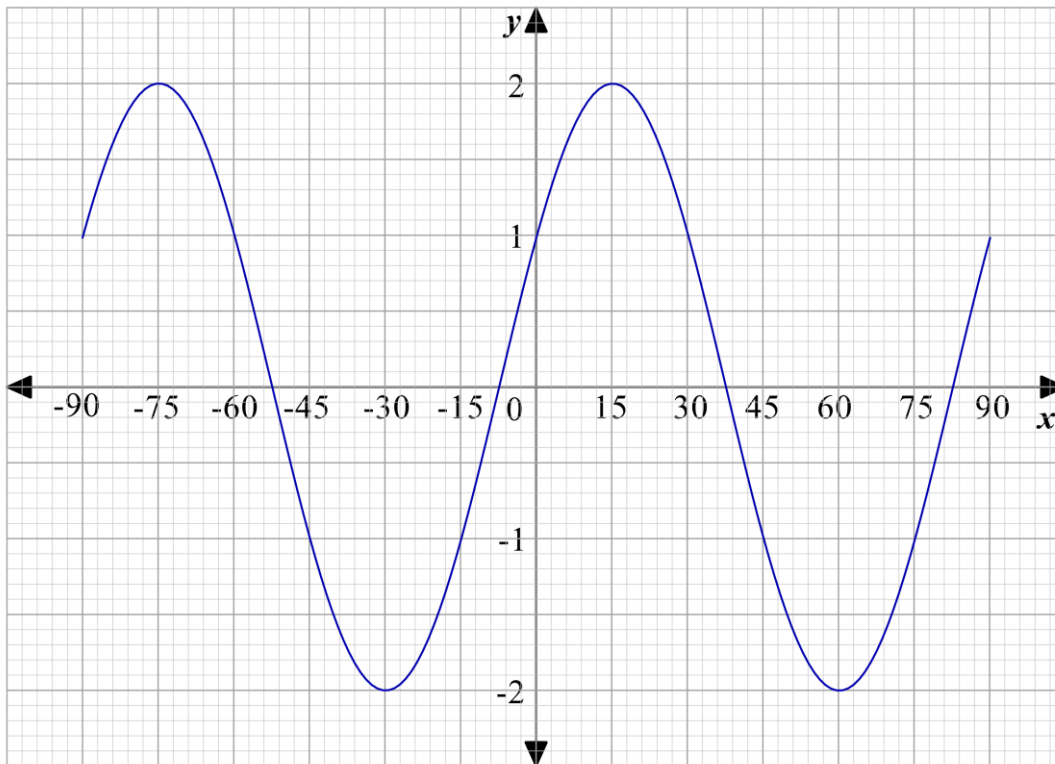
13. Points $A(-4, 7)$, $B(4, 1)$ and $C(16, -8)$ lie on a straight line. Determine the ratio in which B divides AC . (3 marks)

14. A transformation matrix $\mathbf{T} = \begin{pmatrix} a+1 & 4 \\ 4 & a+1 \end{pmatrix}$ maps a triangle PQR of area 0.5 unit squares onto a triangle $P'Q'R'$ of area 4.5 unit squares. Determine the possible values of a . (3 marks)

15. A particle starts from a point O and moves in a straight line. Its velocity V m/s at time t seconds is given by $V = 4 - t$. The distance S of the particle from O at time $t = 2$ seconds is 7 m. Calculate S when $t = 4$ seconds. (3 marks)



16. The following graph represents a wave of the trigonometric function $y = A \sin(\omega x + 30)^\circ$ for $-90^\circ \leq x \leq 90^\circ$.



Determine the values of scalars A and ω .

(3 marks)



SECTION II (50 marks)

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

17. Two varieties of ground nuts type q and type r are sold in the market. Type q is sold at Ksh. 130 per kg while type r is sold at Ksh. 180 per kg.
- (a) A trader bought 50 kg of type q and 75 kg of type r from the market. The two varieties were then mixed.
- (i) Determine the cost price of 1 kg of the mixture; (2 marks)
- (ii) The trader sold 80% of the mixture at Ksh. 170 per kg and the rest at Ksh. 180 per kg. Determine the percentage profit made by the trader. (4 marks)
- (b) Another trader bought and mixed the two varieties of ground nuts. The trader made a profit of 25% by selling the mixture at Ksh. 200 per kg. Determine the ratio in which the trader mixed the two varieties. (4 marks)



18. Registering for a Music club costs Ksh. 7 000 while for a Mathematics club costs Ksh. 7 200. The registration cost is shared equally among members of each club. Originally, both clubs had x members each. However, before payment for registration, 5 Music club members switched to Mathematics club.

(a) Write an expression in terms of x for the amount contributed by:

(i) each Music club member after the switch; (1 mark)

(ii) each Mathematics club member after the switch. (1 mark)

(b) Given that a Music club member contributed Ksh. 40 more than a Mathematics club member:

(i) form an equation in x and hence determine the value of x ; (5 marks)

(ii) determine the percentage increase in the amount contributed by each remaining Music club member due to the switch. (3 marks)



19. The income tax rates of a certain year were as shown in the following table.

Monthly taxable income in Kenya shillings (Ksh.)	Tax Rates (%)
0 – 24 000	10
24 001 – 32 333	25
32 334 – 500 000	30
500 001 – 800 000	32.5
Over 800 000	35

In March that year, Judy's monthly earnings were as follows:

Basic salary	Ksh. 104 644
House allowance	Ksh. 25 000
Commuter allowance	Ksh. 12 000

Judy was entitled to a monthly tax relief of Ksh. 2 400.

(a) Calculate:

(i) Judy's taxable income that month; (2 marks)

(ii) The tax payable by Judy that month. (5 marks)

(b) In July that year, Judy's basic salary changed, her allowances and monthly tax relief remaining as before. Her net tax that month was Ksh. 39 483.35.

Calculate her new basic salary. (3 marks)



20.

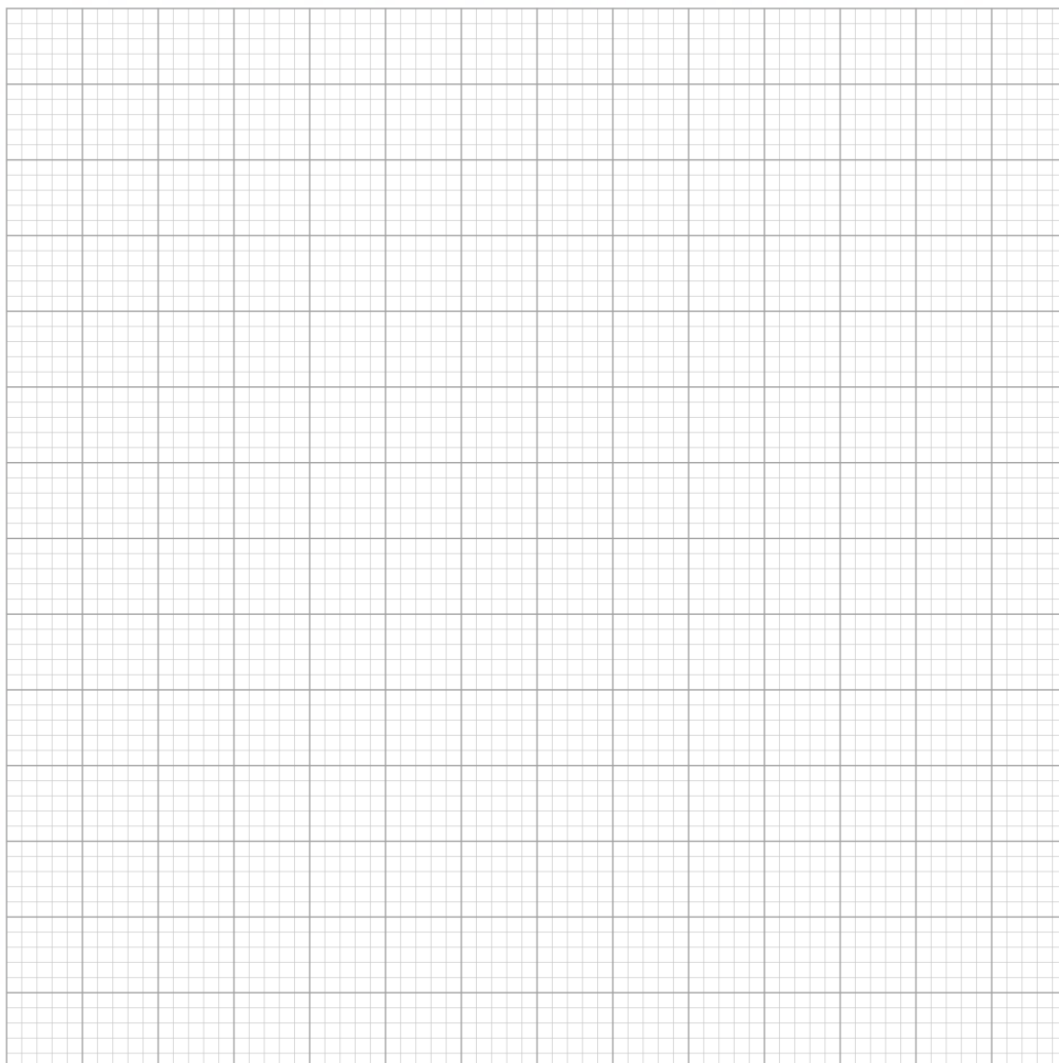
- (a) The following table shows values of x and some values of y for the curve $y = 5 + 10x - 2x^2 - 4x^3$ for $-2 \leq x \leq 2$.

Complete the table by filling in the missing values of y .

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y		-1	-3		5		9	2	

(2 marks)

- (b) On the grid provided, draw the graph of $y = 5 + 10x - 2x^2 - 4x^3$. Use the scale 2 cm to represent 1 unit on x -axis, 2 cm represents 5 units on y -axis. (3 marks)



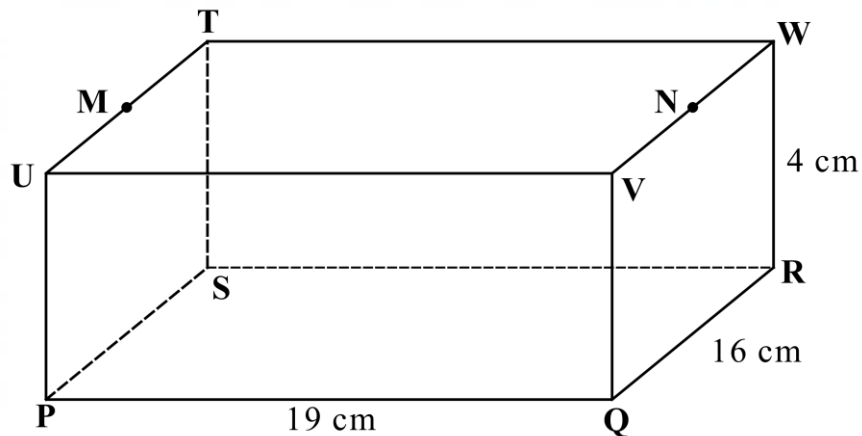
(c)

(i) Use the graph to solve the equation $5 + 10x - 2x^2 - 4x^3 = 0$. (1 mark)

(ii) By drawing a suitable straight line on the graph, solve the equation:
 $4x^3 + 2x^2 - 12x - 3 = 0$. (4 marks)



21. The following figure represents a cuboid **PQRSTU****VW**. Line $PQ = 19$ cm, $QR = 16$ cm and $RW = 4$ cm. Points **M** and **N** are midpoints of lines **UT** and **VW** respectively.



- (a) Calculate the length of line **RM**. (2 marks)
- (b) Calculate correct to 2 decimal places:
- (i) the angle between line **RM** and the plane **PQRS**; (2 marks)
- (ii) the angle between lines **RM** and **MQ**; (3 marks)
- (iii) the obtuse angle between planes **PMNQ** and **MNWT**. (3 marks)



22. A bag contains five balls randomly numbered 1 to 5. The balls are identical except for colour.

(a) Two balls are randomly drawn from the bag, one at a time without replacement.

(i) Draw a probability space to show all the possible pairs of numbers on the two balls drawn from the bag. (2 marks)

(ii) Find the probability that both the numbers on the balls drawn from the bag were greater than 3. (1 mark)

(iii) Find the probability that the sum of the two numbers on the balls drawn does not exceed 6. (2 marks)

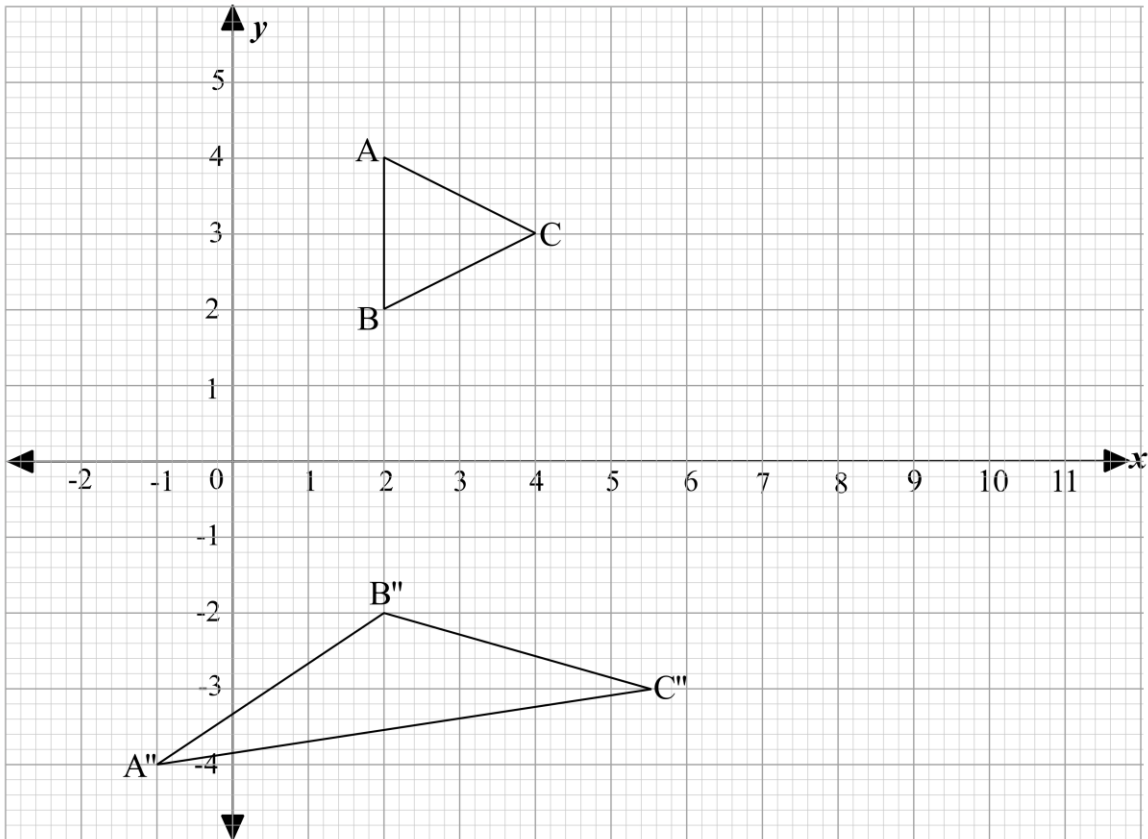
(b) Three balls in the bag are green in colour and the rest are red. Determine the probability that the two balls drawn in (a) were:

(i) of the same colour; (3 marks)

(ii) of mixed colours. (2 marks)



23. Triangle $A''B''C''$ is the image of triangle ABC under transformations $T_1 = \begin{pmatrix} 2.5 & 0 \\ 0 & 1 \end{pmatrix}$ followed by $T_2 = \begin{pmatrix} 1 & -1.5 \\ 0 & -1 \end{pmatrix}$. Triangles ABC and $A''B''C''$ are drawn on the following grid.



(a)

- (i) On the same grid provided, draw $\Delta A'B'C'$, the image of ABC under

transformation matrix $T_1 = \begin{pmatrix} 2.5 & 0 \\ 0 & 1 \end{pmatrix}$. (3 marks)



(ii) Describe fully the transformation represented by matrix T_1 . (2 marks)

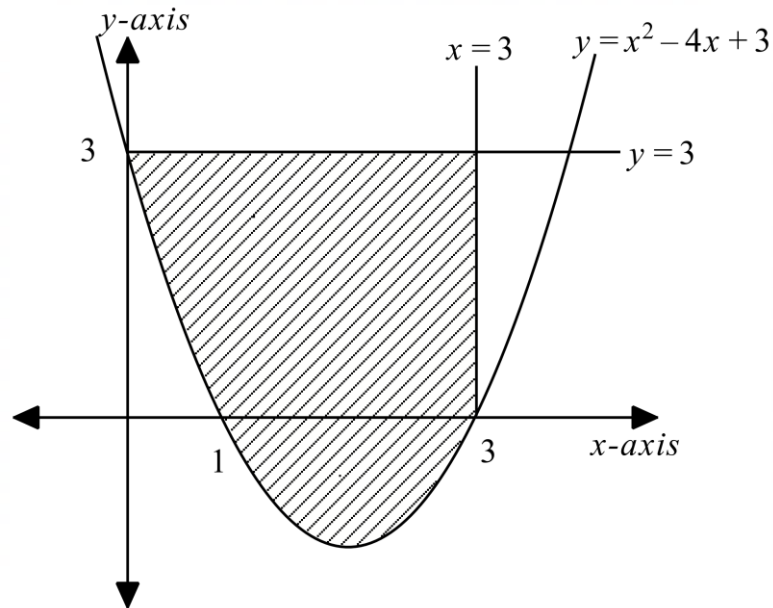
(b)

(i) Find the single transformation matrix that maps ΔABC onto $\Delta A''B''C''$. (2 marks)

(ii) Determine the area of $\Delta A''B''C''$. (3 marks)



24. The following figure is a sketch of the curve whose equation is $y = x^2 - 4x + 3$. The y -intercept of the curve is at $y = 3$ while the x -intercepts are at $x = 1$ and $x = 3$. The region bounded by the curve, the line $y = 3$ and the line $x = 3$ is shaded.



(a)

- (i) Evaluate $\int_0^1 (x^2 - 4x + 3) dx$ (3 marks)

- (ii) Calculate the area of the shaded region above the x -axis. (2 marks)



(b) Calculate the area of the shaded region below the x -axis.

(3 marks)

(c) Calculate the area of the entire shaded region.

(2 marks)

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