

**THE KENYA NATIONAL EXAMINATIONS COUNCIL**  
**Kenya Certificate of Secondary Education**

121/1



**MATHEMATICS Alt. A**

Paper 1

**Nov. 2024 – 2½ hours**

Candidate's signature: ..... Date: .....

**Instructions to candidates**

- (a) Confirm that this question paper has your name and the correct index number.
- (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** the questions in **Section I** and only **five** questions from **Section II**.
- (e) **Show all the steps in your calculation, 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 18 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.

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**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 Without using mathematical tables or a calculator, evaluate  $\frac{0.13 \times 0.3 - 0.003}{0.09}$  giving the answer in decimal form. (3 marks)
  
- 2 Simplify the expression  $\frac{4x^2 - 9}{2x^2 + x - 6}$ . (3 marks)



- 3 A straight line  $L_1$  whose equation is  $y = 2 - \frac{1}{3}x$  meets the  $y$ -axis at Q. Another straight line  $L_2$  is perpendicular to  $L_1$  at Q. Find the equation of  $L_2$  in the form  $y = mx + c$  where  $m$  and  $c$  are constants. (3 marks)
- 4 A circle of radius 3 cm passes through all the vertices of a regular hexagon. Determine the area of the circle that lies outside the hexagon. (3 marks)
- 5 Solve for  $x$  in the equation  $25^x = 125^{\frac{2}{3}} \div 5^{-1}$ . (3 marks)



- 6 A carpenter had two big pieces of wood of equal length. The carpenter cut the first piece into smaller pieces of length 15 cm each without remainder. The carpenter cut the second piece into smaller pieces of length 24 cm each without remainder. Determine the minimum length of each of the big pieces of wood. (2 marks)

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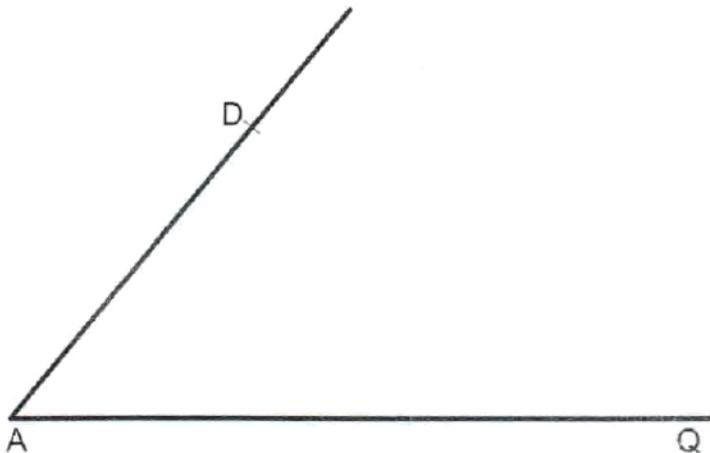
- 7 A cylindrical container of internal radius 10.5 cm has a hemispherical base. The container has water up to a height of 30.5 cm. Calculate the surface area of the container that is in contact with water. (Take  $\pi = \frac{22}{7}$ ) (4 marks)

2

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- 8 In the following figure, points A and D are vertices of a trapezium ABCD. Line DC is parallel to line AQ. Line DC = 4 cm. Point B lies on the line AQ such that angle DCB = 90°.

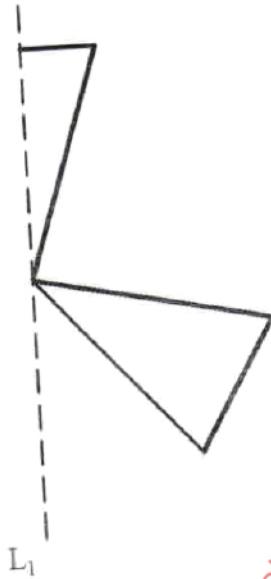


Using a ruler and a pair of compasses only, complete the trapezium. Hence measure the length of line AB. (4 marks)

- 9 The length of a minor arc AB of a circle centre O is 17 cm. The arc AB subtends an angle of 1.25 radians at O. Calculate the area of the minor sector AOB. (3 marks)



- 10** The following figure represents a part of a pattern. A line of symmetry,  $L_1$ , of the pattern is also shown.



Complete the pattern and hence state the order of rotational symmetry of the pattern.

(3 marks)

- 11** A Kenyan bank bought and sold foreign currencies on two different dates as shown.

		Buying (In Ksh)	Selling (In Ksh)
12/1/2021	1 South African rand	7.08	7.10
12/2/2021	100 Tanzanian shillings	21.12	21.25

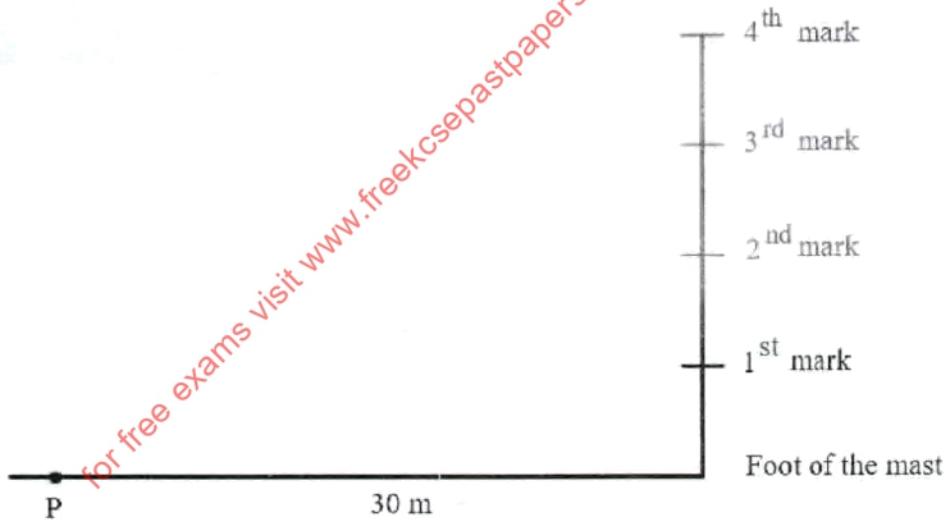
A South African tourist arrived in Kenya on 12/1/2021 with 15 000 South African rands. He changed the whole amount to Kenyan shillings. While in Kenya, he spent a total of Ksh 53 075 and changed the balance to Tanzanian shillings before leaving for Tanzania on 12/2/2021. Determine, in Tanzanian shillings, the amount he received.

(3 marks)



- 12 The coordinates of points O, A, B and C are (0, 0), (2, 1), (4, 4) and (-1, 7) respectively. The coordinates of point D is  $(x, y)$ . Point M is the midpoint of line CD and it satisfies the vector equation  $\mathbf{OM} = \mathbf{OA} + \frac{5}{2}\mathbf{AB}$ . Determine the coordinates of point D. (3 marks)

- 13 The following figure (not drawn to scale) represents a communication mast. The mast has been divided into 4 equal parts. A point P is 30 m from the foot of the mast on the same ground level.



The angle of elevation of the 3<sup>rd</sup> mark from P is 50°.

Calculate the height of the mast.

(4 marks)



- 14** The following frequency distribution table shows the mass, in kilograms, of maize flour sold by 30 traders.

**10**

Mass (in kg)	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59
No. of traders	3	8	10	7	2

Calculate the median mass of maize flour sold.

(3 marks)

- 15** The table below shows values of  $x$  and some values of  $y$  for the curve  $y = x^2$  for  $0 \leq x \leq 3$ .

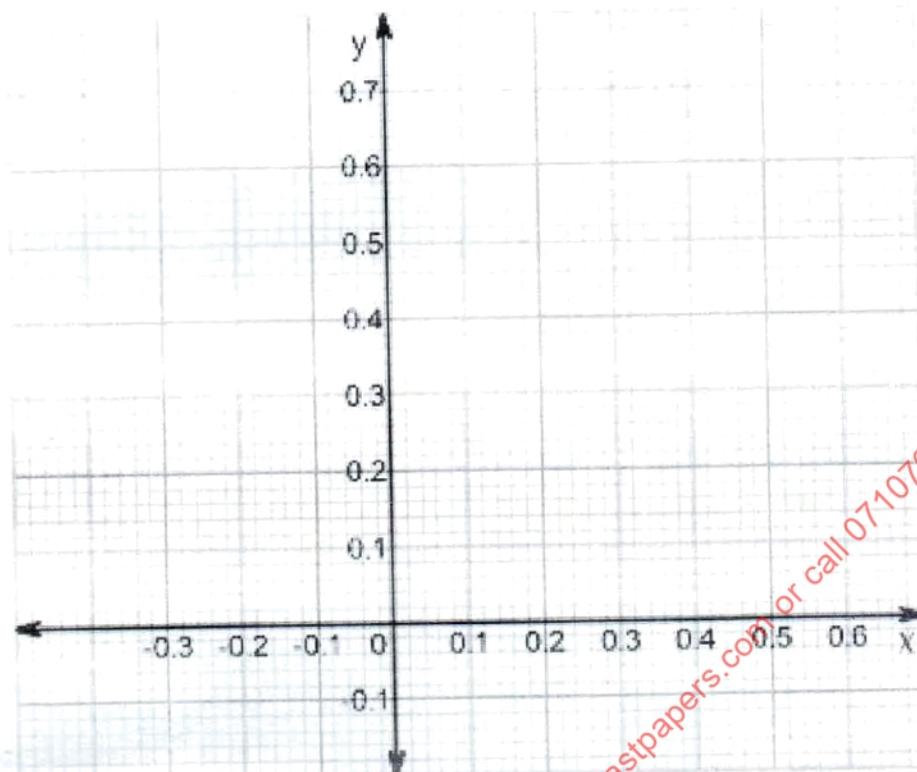
$x$	0	0.5	1	1.5	2	2.5	3
$y$	0	0.25	1		4		9

- (a) Complete the table by filling in the missing values of  $y$ . (1 mark)
- (b) Use the mid ordinate rule with 3 strips to estimate the area bounded by the curve  $y = x^2$ , the  $x$ -axis and the line  $x = 3$ . (2 marks)



9

Use the cartesian plane provided to solve graphically the simultaneous equations  $2x + 3y = 1.2$  and  $5x + 4y = 1$ .



(3 marks)

k)

k)

s)

s)



## SECTION II (50 marks)

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

- 17** On a market day, Abdul had 32 goats while Chebet had 56 goats. Chebet sold twice as many goats as Abdul. After the sale, the number of the goats that Abdul and Chebet remained with was in the ratio 3 : 5 respectively.
- (a) Determine the total number of goats sold by Abdul and Chebet at the market. (4 marks)
- (b) Abdul and Chebet raised a total of Ksh 97 600 from the sale of goats at the market. Abdul's selling price per goat was 5% higher than that of Chebet. Determine the ratio of the earnings of Abdul to Chebet from the sale of goats. (4 marks)
- (c) Abdul decreased the selling price per goat in the ratio 19:21 for the goats that remained. Determine the new selling price per goat. (2 marks)



11

- 18** The price of pens in a bookshop changed in the months of February, March and April. The price of a pen was sh 2 less in the month of February than the price of a pen in the month of March. In the month of April the price of a pen was sh 2 more than the price of a pen in the month of March. The bookshop sold pens worth Ksh 4 200 in February. In April, pens worth Ksh 4 500 were sold.

Take Ksh  $x$  to be the price of a pen in March.

- (a) Write an expression in  $x$  for the number of pens sold by the bookshop in:
- February; (1 mark)
  - April. (1 mark)
- (b) The bookshop sold 50 more pens in February than in April. Determine the number of pens sold in February. (6 marks)
- (c) Determine the percentage change in the number of pens sold by the bookshop in April compared to the number sold in February. (2 marks)



- 19** Airport S is 1700 km on a bearing of  $300^\circ$  from airport R. Airport Q is 800 km on a bearing of  $215^\circ$  from R.

In the following figure, airport R is represented by point R.

17



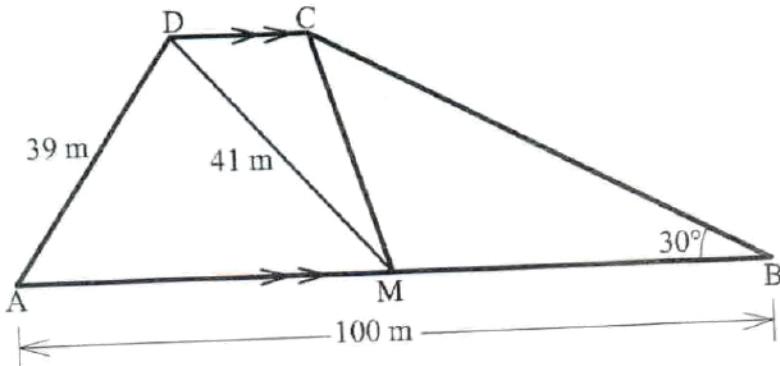
- (a) Using a scale of 1 cm to represent 200 km, show on the figure the relative positions of airports S and Q. (3 marks)
- (b) Use the scale drawing to determine:
- the distance from airport S to airport Q in kilometres; (1 mark)
  - the bearing of S from Q. (2 marks)
- (c) An aircraft flying at a speed of 400 km/h left S for Q at 8.00 am. Determine the time when the aircraft was exactly 1000 km from airport R on its way to Q. (4 marks)



13

20

The following figure represents a piece of land in the shape of a trapezium ABCD. Lines AB and DC are parallel. Point M is the midpoint of AB. The land is divided into three triangular plots. Line AB = 100 m, AD = 39 m, MD = 41 m and angle ABC =  $30^\circ$ .



- (a) Calculate the area of the triangular plot AMD and hence the perpendicular distance between the two parallel sides. (4 marks)

- (b) Calculate the length of:  
(i) BC; (2 marks)

- (ii) MC. (2 marks)

- (c) Calculate the size of the obtuse angle BMC. (2 marks)



- 21** Two matrices  $\mathbf{P}$  and  $\mathbf{Q}$  are such that  $\mathbf{P} = \begin{pmatrix} 3 & 7 \\ h & 4 \end{pmatrix}$  and  $\mathbf{Q} = \begin{pmatrix} 5 & -4 \\ 3 & -2 \end{pmatrix}$ . The determinant of  $\mathbf{PQ} = 3$ .

(a) (i) Determine the value of  $h$ . (3 marks)

(ii) Find  $\mathbf{P}^{-1}$ , the inverse of matrix  $\mathbf{P}$ . (2 marks)

- (b) Patel and Lagat purchased watches at sh  $m$  per watch and phones at sh  $n$  per phone. Patel purchased 12 watches and 28 phones for Ksh 24 600. Lagat purchased 15 watches and 40 phones for Ksh 34 500.

(i) Form two equations in  $m$  and  $n$ . (2 marks)

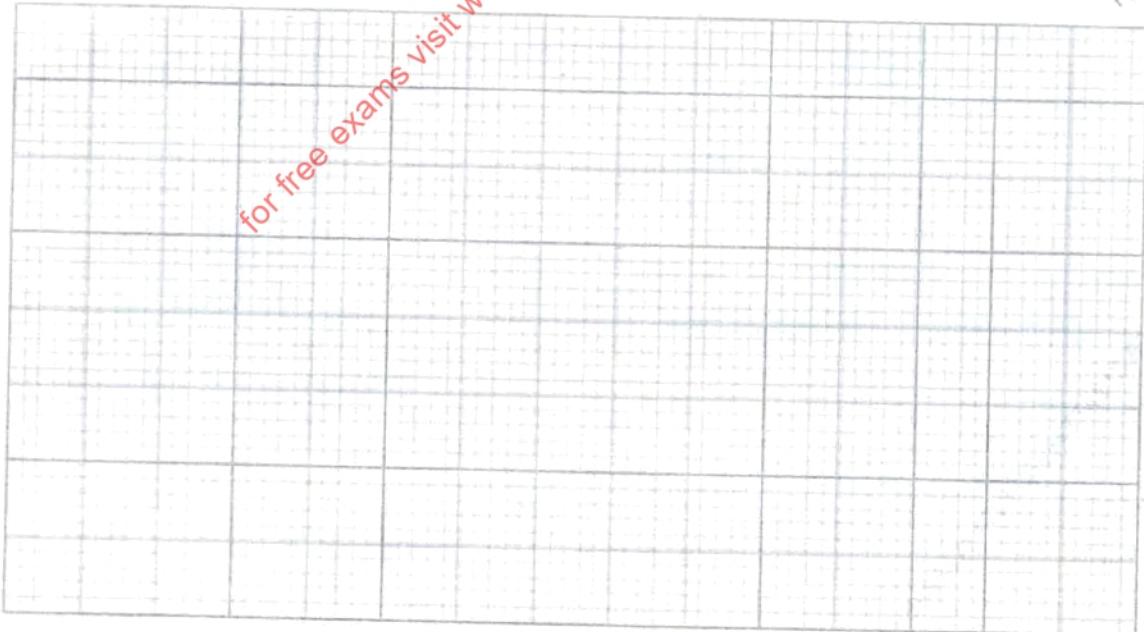
(ii) Use the matrix method to determine the price of a watch and that of a phone. (3 marks)



- 22 Members of the Environmental Club planted trees. The number of trees planted by each member is recorded as follows.

24	7	11	6	12	27	8	9	33	23
12	32	19	33	16	21	14	16	17	10
21	18	16	9	17	8	28	13	8	19
9	17	24	18	29	15	12	31	22	14

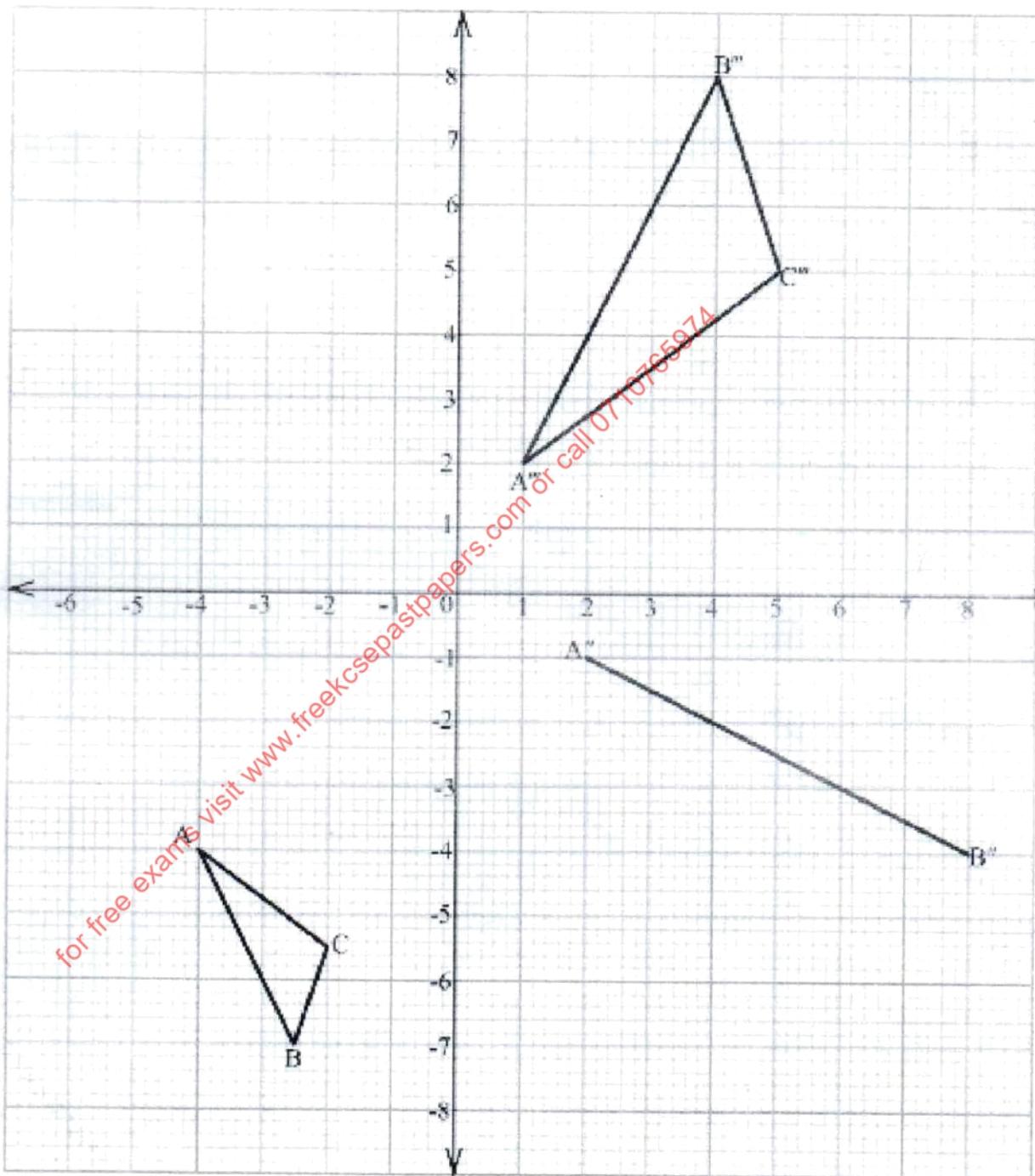
- (a) (i) Using a class width of 5 and starting with the class 6 - 10, make a frequency distribution table for the data. (2 marks)
- (ii) State the modal class. (1 mark)
- (iii) Estimate the mean number of trees planted. (3 marks)
- (b) On the grid provided and on the same axes represent the data using:
- (i) a histogram; (3 marks)  
(ii) a frequency polygon. (1 mark)



- 23 On the cartesian plane below, triangle ABC has vertices  $A(-4, -4)$ ,  $B(-2.5, -7)$  and  $C(-2, -5.5)$  while triangle  $A''B''C''$  has vertices  $A''(1, 2)$ ,  $B''(4, 8)$  and  $C''(5, 5)$ . The line joining  $A''(2, -1)$ ,  $B''(8, -4)$  is part of another triangle  $A''B''C''$ .

21 Tw  
Pc

(a)



17

18

Triangle A'B'C' is the image of triangle ABC under an enlargement centre  $(-3, -2)$  and scale factor (S.F)  $\frac{1}{2}$ . The gradient of the curve  $y = x^3 + 5x^2 + Px - 18$  at  $x = -1$  is  $-15$ . (3 marks)

(a) Find:

(i) the value of P; (3 marks)

(b) Triangle A''B''C'' is the image of triangle A'B'C' under rotation centre O(0, 0).

(i) State the angle of rotation. (1 mark)

(ii) Complete triangle A''B''C''. (2 marks)

(iii) the equation of the normal to the tangent to the curve at  $x = -1$ . (3 marks)

(c) Triangle A''B''C'' is the image of triangle A''B''C'' under a reflection.

(i) Draw the mirror line. (1 mark)

(ii) Determine the equation of the mirror line in the form  $y = mx + c$ . (2 marks)

(b) Find the coordinates of the turning points of the curve. (4 marks)

(d) Describe fully a single transformation that maps triangle A'B'C' onto triangle A''B''C''. (1 mark)

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