121/1 – MATHEMATICS ALT A – Paper 1

Nov. 2017 – 2½ hours

Name .... Index Number ....

Candidate's Signature .... Date ....

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** the questions in **Section I** and only **five** question from **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 calculator **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

917630

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SECTION I (50 marks)

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

1. Evaluate $\sqrt{\dfrac{0.0961}{4.0836-3.7112}}$, correct to four decimal places, hence write the answer in standard form. (3 marks)
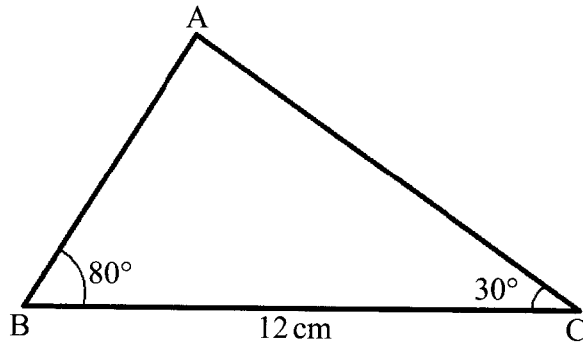
2. Two numbers p and q are such that $p^3 \times q = 189$. Find p and q. (3 marks)

3. A trader bought maize for Ksh 20 per kilogram and beans for **Ksh 60 per kilogram. She mixed the maize and beans** and sold the mixture at Ksh 48 per kilogram. If she made a 60% profit, determine the ratio maize:beans per kilogram in the mixture. (4 marks)

4. In the triangle ABC below, BC = 12 cm, $\angle ABC = 80°$ and $\angle ACB = 30°$.

Calculate. correct to 4 significant figures. the area of triangle ABC. (3 marks)

5. Given that the exterior angle of a regular hexagon is x, find the size of each interior angle of the hexagon. (2 marks)

6. Use logarithms to evaluate, $\sqrt[3]{\dfrac{(1.654)^2}{45.73 \times 0.56}}$. (4 marks)

7. A line L is perpendicular to the line $\frac{2}{3}x + \frac{5}{7}y = 1$. Given that L passes through (4,11), find:

    (a)   gradient of L;   (1 mark)

    (b)   equation of L in the form $y = mx + c$, where m and c are constants.   (2 marks)

8. Convert $\frac{2\pi^c}{9}$ into degrees.   (2 marks)

9. A garden is in the shape of a right angled triangle. The length of the shortest side is 17 m and the area of the garden is 346.8 m². Calculate the length of the longest side of the garden.

                                                                          (3 marks)

10. The diagram below shows a region R bounded by three lines L_1, L_2 and L_3
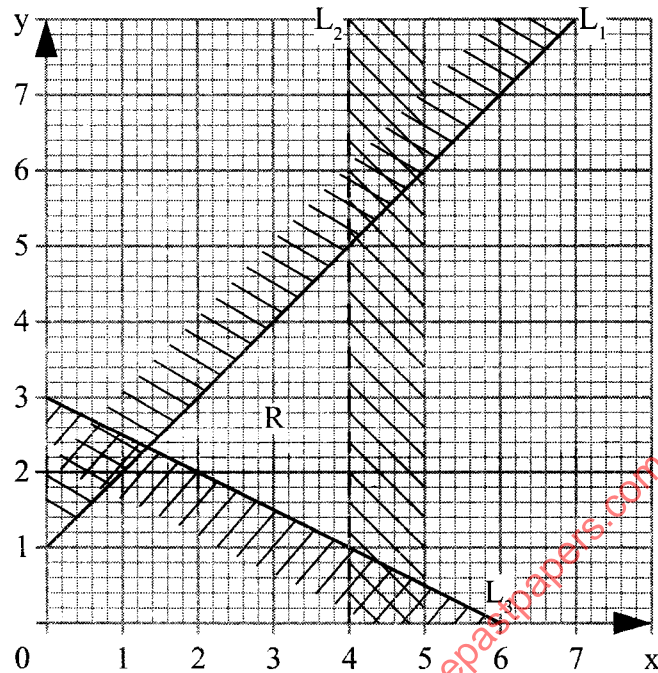
Form the three inequalities that satisfy the given region R. (3 marks)

11. Murimi and Naliaka had each 840 tree seedlings. Murimi planted equal number of seedlings per row in x rows while Naliaka planted equal number of seedlings in $(x + 1)$ rows. The number of tree seedlings planted by Murimi in each row were 4 more than those planted by Naliaka in each row. Calculate the number of seedlings Murimi planted in each row.

(4 marks)

12.   A Kenyan bank buys and sells foreign currencies as shown below:

	Buying (Ksh)	Selling (Ksh)
1 Sterling pound (£)	130.10	130.54
1 South African Rand	9.52	9.58

A businessman on a trip to Kenya had £50 000 which he converted to Kenya shillings. While in Kenya, he spent 80% of the money and changed the balance to South African Rand. Calculate, to the nearest Rand, the amount he obtained.   (3 marks)

13.   Use the mid ordinate rule with six strips to find the area bounded by the curve $y = x^2 + 1$, the lines $x = -4$, $x = 8$ and the x-axis.   (3 marks)

14.   Given that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} -2 \\ -5 \end{pmatrix}$ and $3\mathbf{a} - 2\mathbf{b} + 4\mathbf{c} = \begin{pmatrix} 10 \\ -19 \end{pmatrix}$, find b.   (3 marks)

15. A triangle T with vertices A (2,4), B (6,2) and C (4,8) is mapped onto triangle T′ with vertices A′(10,0) , B′(8,−4) and C′(14,−2) by a rotation.

(a) On the grid provided draw triangle T and its image.

(2 marks)
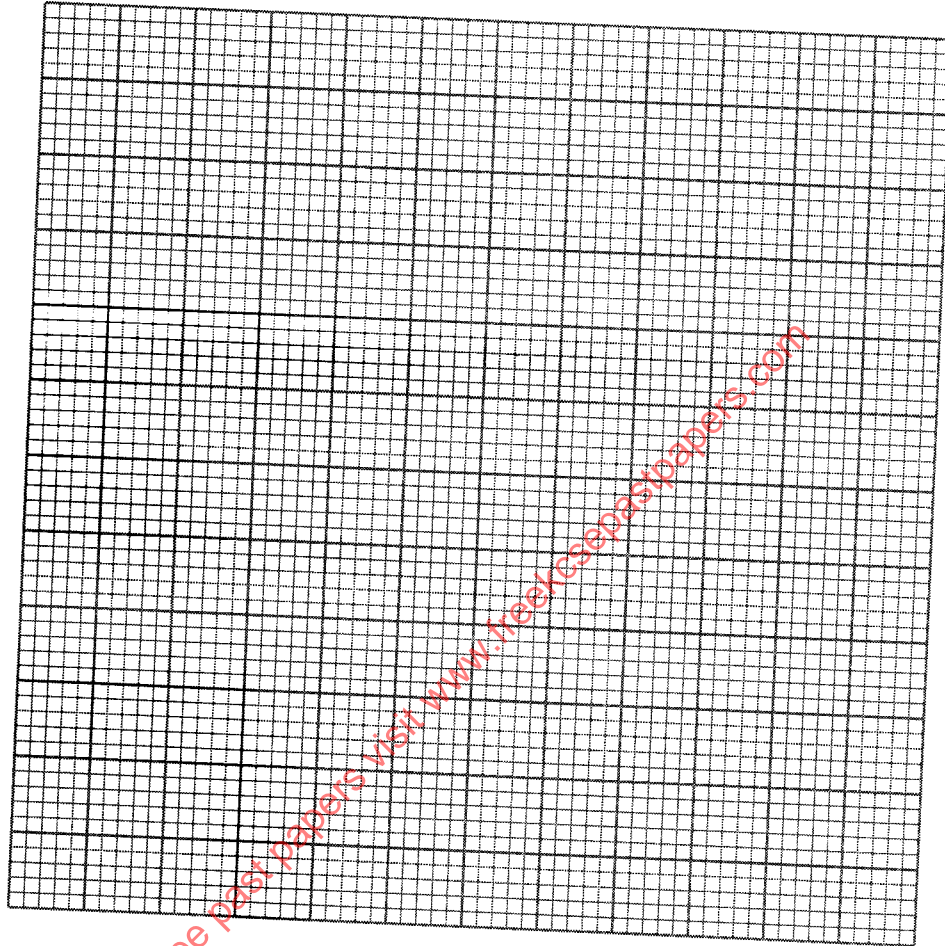
(b) Determine the centre and angle of rotation that maps T onto T′.

(2 marks)

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16. A construction company employs technicians and artisans. On a certain day 3 technicians and 2 artisans were hired and paid a total of Ksh 9 000. On another day the firm hired 4 technicians and 1 artisan and paid a total of Ksh 9 500. Calculate the cost of hiring 2 technicians and 5 artisans in a day. (3 marks)

SECTION II (50 marks)

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

17. Two lines L_1: $2y - 3x - 6 = 0$ and L_2: $3y + x - 20 = 0$ intersect at a point A.

    (a) Find the coordinates of A. (3 marks)

    (b) A third line L_3 is perpendicular to L_2 at point A. Find the equation of L_3 in the form $y = mx + c$, where m and c are constants. (3 marks)

    (c) Another line L_4 is parallel to L_1 and passes through (–1,3). Find the x and y intercepts of L_4. (4 marks)

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18. The masses, in kilograms, of patients who attended a clinic on a certain day were recorded as follows.

38	52	46	48	60	59	62	73	49	54
49	41	57	58	69	72	60	58	42	41
79	62	58	67	54	60	65	61	48	47
69	59	70	52	63	58	59	49	51	44
67	49	51	58	54	59	39	59	54	52

(a) Starting with the class 35 – 39, make a frequency distribution table for the data.
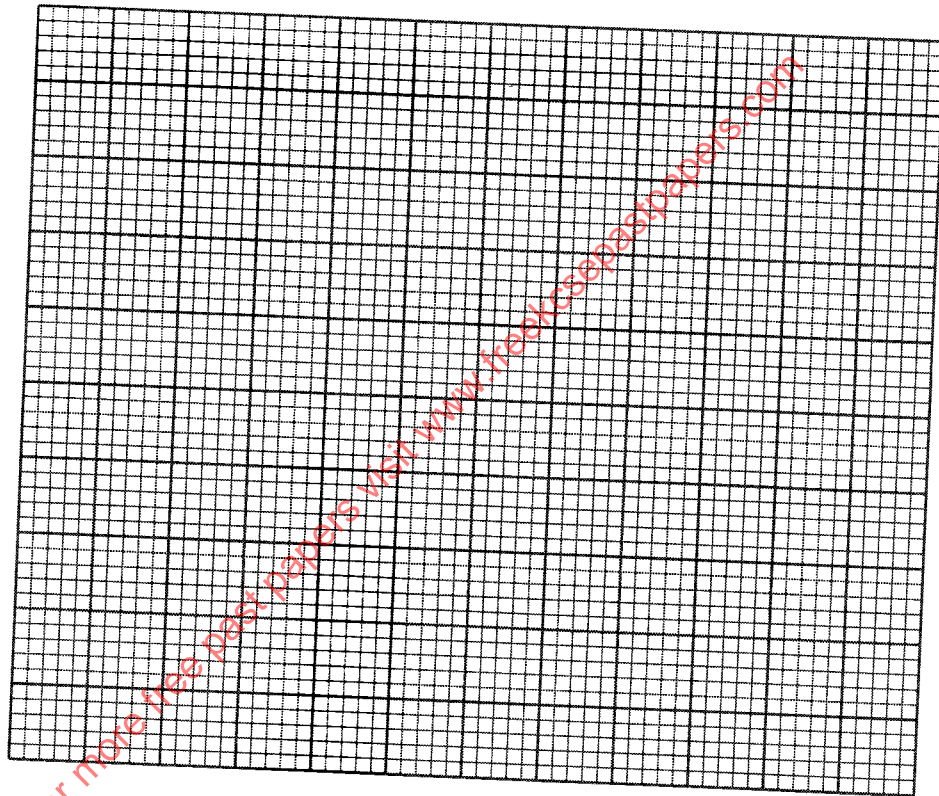
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(b) Calculate:

  (i) the mean mass; (3 m

    (ii)   the median mass.

(3 marks)

(c)   On the grid provided draw a histogram to represent the data.

(2 marks)

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19. A solid S is made up of a cylindrical part and a conical part. The height of the solid is 4.5 m. The common radius of the cylindrical part and the conical part is 0.9 m. The height of the conical part is 1.5 m.

(a) Calculate the volume, correct to 1 decimal place, of solid S. (4 marks)
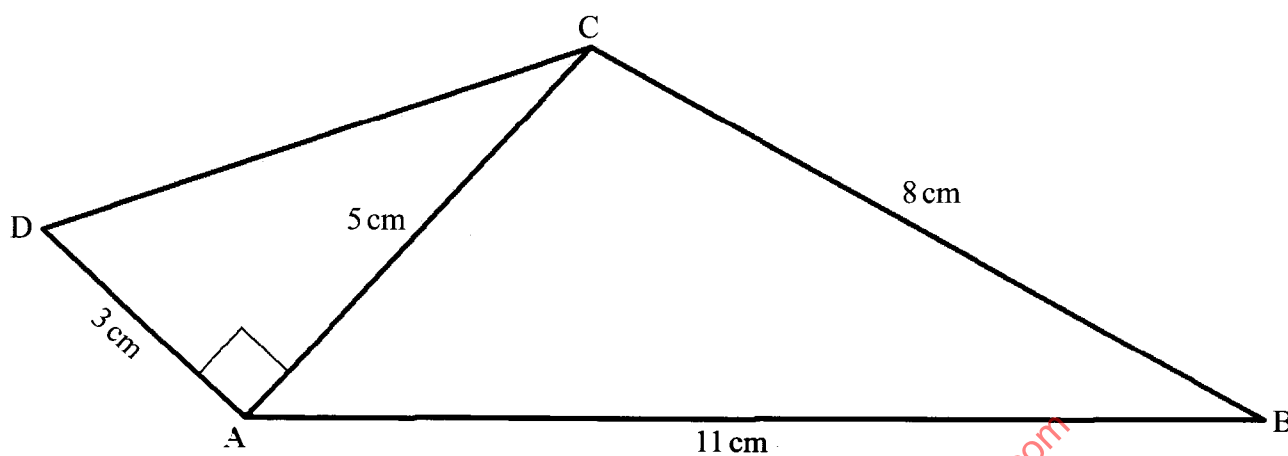
(b) Calculate the total surface area of solid S. (4 marks)

(c) A square base pillar of side 1.6 m has the same volume as solid S. Determine the height of the pillar, correct to 1 decimal place. (2 marks)

20. In the figure below (not drawn to scale), AB = 11 cm, BC = 8 cm, AD = 3 cm, AC = 5 cm and ∠ DAC is a right angle.

Calculate, correct to one decimal place:

(a)   the length DC;   (2 marks)

(b)   the size of ∠ ADC;   (2 marks)

(c)   the size of ∠ ACB;   (3 marks)

(d)   the area of the quadrilateral ABCD.   (3 marks)

21. The corner points A, B, C and D of a ranch are such that B is 8 km directly East of A and C is 6 km from B on a bearing of 30°. D is 7 km from C on a bearing of 300°.

   (a)   Using a scale of 1 cm to represent 1 km, draw a diagram to show the positions of A, B, C and D.   (4 marks)

   (b)   Use the scale drawing to determine:

      (i)   the bearing of A from D;   (1 mark)

      (ii)   the distance BD in kilometres.   (2 marks)

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(iii)   the perimeter of the ranch in kilometres   (3 marks)

22. (a) Given that $\mathbf{A} = \begin{pmatrix} 3 & x \\ x+1 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix}$, find values of x for which $\mathbf{AB}$ is a

singular matrix. (4 marks)

(b) Mambo bought 3 exercise books and 5 pens for a total of Ksh 165. If Mambo had bought 2 exercise books and 4 pens, he would have spent Ksh 45 less. Taking x to represent the price of an exercise book and y to represent the price of a pen:

(i) Form two equations to represent the above information. (1 mark)

(ii) Use matrix method to find the price of an exercise book and that of a pen. (3 marks)

(iii) A teacher of a class of 36 students bought 2 exercise books and 1 pen for each student. Calculate the total amount of money the teacher paid for the books and pens. (2 marks)

23. An institution intended to buy a certain number of chairs for Ksh 16 200. The supplier agreed to offer a discount of Ksh 60 per chair which enabled the institution to get 3 more chairs. Taking x as the originally intended number of chairs,

(a)   Write an expressions in terms of x for:

   (i)   original price per chair;

(1 mark)

   (ii)   price per chair after discount.

(1 mark)

(b)   Determine:

   (i)   the number of chairs the institution originally intended to buy;

(4 marks)

   (ii)   price per chair after discount;

(2 marks)

   (iii)   the amount of money the institution would have saved per chair if it bought the intended number of chairs at a discount of 15%.

(2 marks)

24. The equation of a curve is given as $y = 2x^3 - \dfrac{9}{2}x^2 - 15x + 3$.

    (a)   Find:

           (i)   the value of y when $x = 2$;   (2 marks)

           (ii)   the equation of the tangent to the curve at $x = 2$.   (4 marks)

    (b)   Determine the turning points of the curve.   (4 marks)

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