

MATHEMATICS ALT A 121

NAME ADM NO.

CLASS DATE

ST TERESA'S GIRLS' SECONDARY SCHOOL.

OPENER TERM THREE FORM 3

TIME: 2½ HOURS

INSTRUCTIONS TO STUDENTS

- Write your name, class, admission number and date in the spaces provided above.
- This paper consists of **TWO** sections. **Section I** and **Section II**.
- Answer **ALL** the questions in **section I** and any **FIVE** questions from **Section II**.
- All answers and working must be written on the question paper in the space provided below each question.
- Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
- Marks may be given for correct working even if the answer is wrong.
- Non-programmable silent calculators and KNEC mathematical tables may be used except where stated otherwise.
- This paper consists of **14** printed papers.

Students should check the question paper to ascertain that all **14** pages are printed as indicated and that no questions are missing.

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 1 (50 Marks)

*Answer **all** the questions in this section*

- 1** (a) Convert the recurring decimal $1.\dot{3}\dot{6}$ into a fraction. (1 mark)

- (b) Hence, without using a calculator, evaluate $\frac{1\frac{1}{2} + 2\frac{1}{4} \div 1.\dot{3}\dot{6} \text{ of } 4\frac{2}{5}}{1\frac{1}{4}}$, leaving the answer as a fraction in its simplest form. (3 marks)

- 2** Given that $\log_a x = 5$ and $\log_a y = 8$; Find $\log_a \left(\frac{a\sqrt{x}}{y} \right)$. (3 marks)

- 3** Three metal rods have lengths 216 cm, 324 cm and 270 cm. The rods are cut into shorter pieces all of the same length and there is no left over metal. What is the maximum length of one of the pieces? (2 marks)

- 4 Simplify the expression; $\frac{9x^3 - 4x}{12x^2 + x - 6}$ (3 marks)
- 5 The exterior angle of a regular polygon is equal to one third of the interior angle. Calculate the number of sides of the polygon. (3 marks)
- 6 A metal sphere of density 5g/cm^3 has a mass of 22.5π grams. Find the exact radius of the sphere. (3 marks)
- 7 The volumes of two similar cylindrical solids are $2\,528\text{ cm}^3$ and $8\,532\text{ cm}^3$. If the surface area of the smaller one is 176 cm^2 , find the difference in the surface areas of the two cylinders. (3 marks)

8 Use a ruler and a pair of compasses only, construct;

(a) a triangle QRS in which $QR = 5$ cm, $QS = 5.6$ cm and $\angle RQS = 45^\circ$ (2 marks)

(b) the circle that touches all the sides of the triangle. (2 marks)

9 Without using tables or a calculator, work out

$$\sqrt[3]{\frac{0.125 \times 64^{0.5}}{0.064 \times 27}} \quad (3 \text{ marks})$$

10 The equation of perpendicular bisector of the line joining A (-1, 4) and B (2, 2) intersects the x -axis at P and y -axis at Q. Find the co-ordinates of P and Q. (4 marks)

11 Two variables are such that A is partly constant and partly varies as the square root of B.

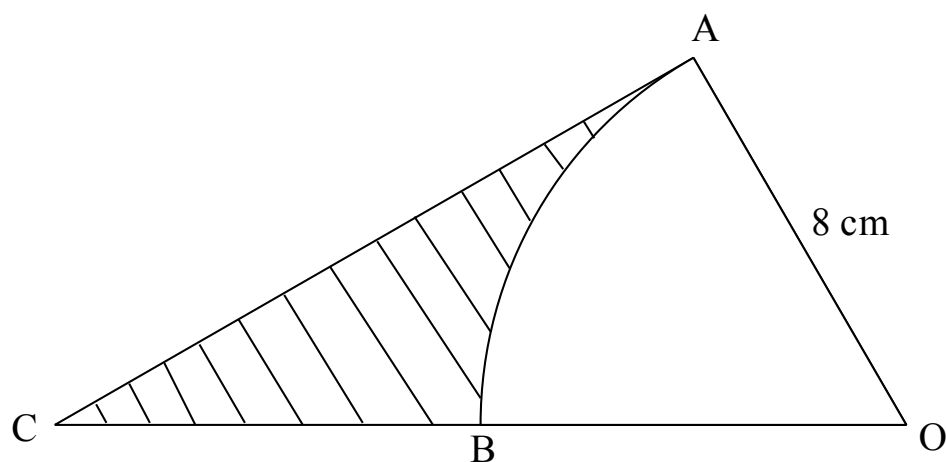
Given that $A = 27$ when $B = \frac{1}{4}$ and $A = 18$; when $B = 25$, find A when $B = 12\frac{1}{4}$. (3 marks)

12 The 16th term of an A.P. is seven times the 8th term. The sum of the first ten terms is -35.
Find the first term. (3 marks)

13 A machine whose cost price is sh 1 000 is to be sold through a salesman at a price of sh 1 500. Calculate the exact percentage discount the salesman would allow so that a profit of 30% is realized. (2 marks)

14 Given that $\sin \theta = \frac{2}{\sqrt{5}}$ and θ is acute find the exact value of; $\frac{\sin \theta}{\tan \theta - \cos \theta}$. (4 marks)

- 15** In the figure below AOB is a sector of a circle of center O radius 8 cm. AC is a tangent to the circle at the point A. CBO is a straight line and the area of sector AOB is 32 cm^2 . Find to one decimal place the area the shaded region. (3 marks)



- 16** Given the inequalities $x - 5 \leq 3x - 8 < 2x - 3$
 (a) Solve the inequalities; (2 marks)

- (b) Represent the solution on a number line. (1 mark)

SECTION 1I (50 Marks)

*Answer only **five questions** in this section*

- 17** A private investor supplies water to all families in an estate. A water pipe of diameter 60 cm is used to distribute water to the families. The water supply operates 5 hours per day at a rate of 3.5 m/s. Each family consumes 15 m³ of water per day.

(a) Calculate the amount of water in litres supplied to the estate in one hour. (5 marks)

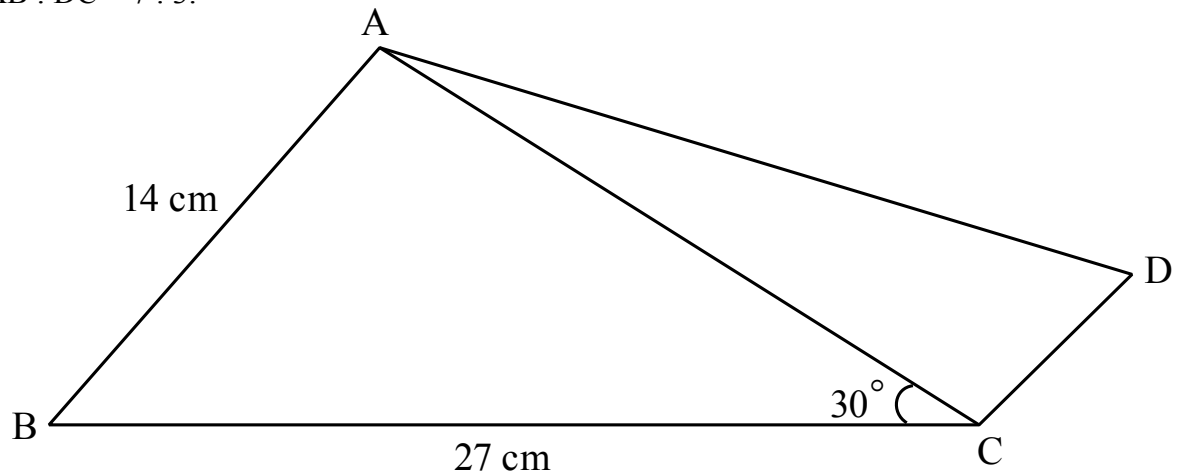
(b) Calculate the minimum number of families in the estate. (3 marks)

(c) If each family pays a flat rate of sh 1 200 per month towards the cost of water, how much will the residents pay. (2 marks)

18 The figure below shows a quadrilateral ABCD where the sides AB and CD are parallel.

Angle BAC is an obtuse angle. Given that $AB = 14 \text{ cm}$. $BC = 27 \text{ cm}$ $\angle ACD = 30^\circ$

$AB : DC = 7 : 3$.



Calculate, correct to two decimal places:

(a) Angle BAC.

(3 marks)

(b) The length of diagonal BD.

(4 marks)

(c) The area of quadrilateral ABCD.

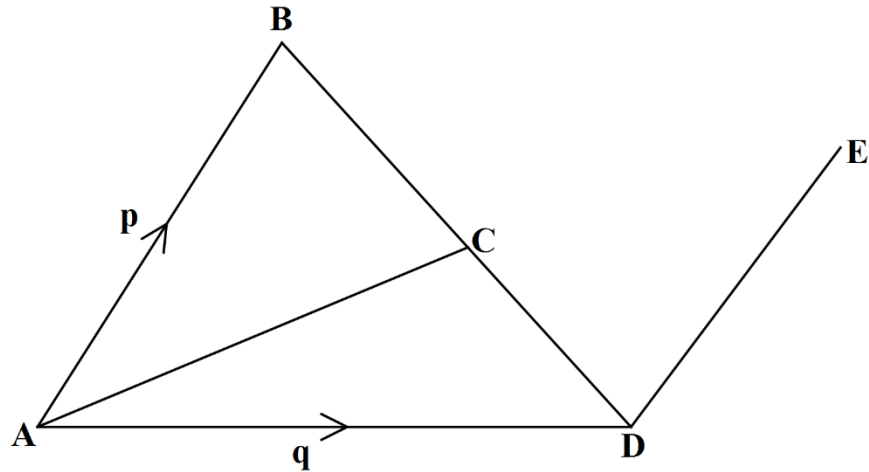
(3 marks)

19 A passenger train and a lorry are both travelling from Town A to Town B. The railway line from Town A to Town B runs parallel to the road. The train started travelling earlier than the lorry. The passenger train is travelling at 25 km/hr and the lorry is travelling at 30 km/hr. The length of the lorry is 5 metres.

(a) From the point of beginning to overtake the train, the lorry takes exactly $1\frac{1}{2}$ minutes to completely overtake the train. Find the length of the train in metres. (4 marks)

(b) From that point of overtaking the train, the lorry travelled for a further 60 km before reaching town B. After 12 minutes of offloading, the lorry started its journey back at the same speed. How far from B did the lorry meet the oncoming train? (6 marks)

20 In the figure below $\mathbf{AB} = \mathbf{p}$, $\mathbf{AD} = \mathbf{q}$, $\mathbf{DE} = \frac{1}{2} \mathbf{AB}$ and $\mathbf{BC} = \frac{2}{3} \mathbf{BD}$.



(a) Find in terms of $\mathbf{p}$ and $\mathbf{q}$ the vectors

(i) $\mathbf{BD}$; (1 mark)

(ii) $\mathbf{BC}$; (1 mark)

(iii) $\mathbf{CD}$; (1 mark)

(iv) $\mathbf{AC}$. (2 marks)

(b) Given that $\mathbf{AC} = k \mathbf{CE}$ where k is a scalar, find:

(i) The value of k , (4 marks)

(ii) The ratio in which C divides AC. (1 mark)

21 (a) Find A^{-1} , the inverse of matrix ; $A = \begin{pmatrix} 6 & 5 \\ 4 & 7 \end{pmatrix}$ (2 marks)

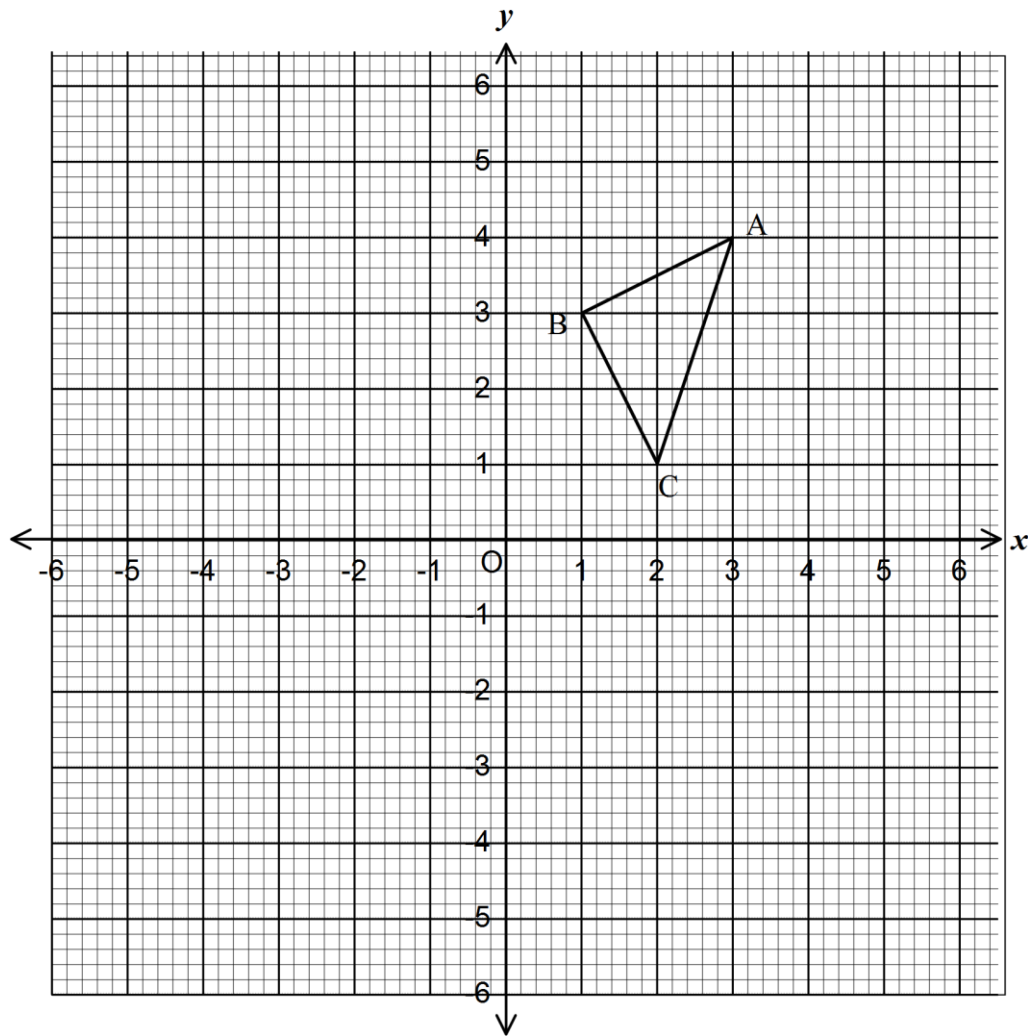
(b) Shrem sells white and brown loaves of bread in his kiosk. On a certain day he sold 6 white loaves of bread and 5 brown ones for a total of Ksh. 520. The next day he sold 4 white loaves and 7 brown ones for a total of Ksh. 530.

(i) Form a matrix equation to represent the above information. (1 mark)

(ii) Use matrix method to find the price of a white loaf of bread and that of a brown loaf of bread. (3 marks)

(c) A school canteen bought 240 white loaves of bread and 100 brown loaves of bread. A discount of 10% was allowed on each white loaf whereas a discount of 13% was allowed on each brown loaf of bread. Calculate the percentage discount on the cost of all the loaves of bread bought. (4 marks)

22 Triangle ABC is shown below

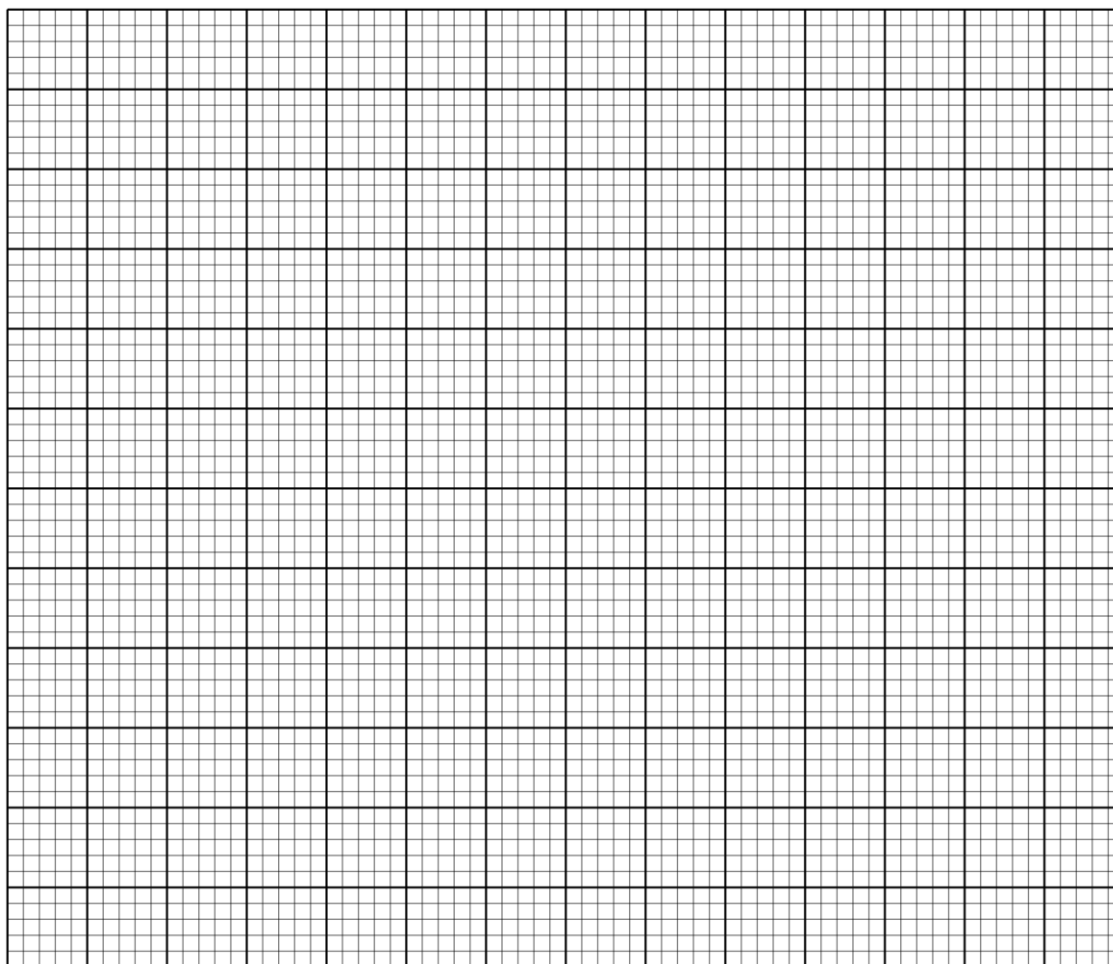


- (a) Draw $\triangle A'B'C'$, the image of triangle ABC under a rotation of $+90^\circ$ about (0, 0) (2 marks)
- (b) Draw triangle $A''B''C''$, the image of triangle $A'B'C'$, under a reflection in the line $y = x$ (2 marks)
- (c) Draw triangle $A'''B'''C'''$, the image of triangle $A''B''C''$ under a rotation of -90° about (0, 0). (2 marks)
- (d) Describe a single transformation that maps triangle ABC onto to triangle $A'''B'''C'''$. (2 marks)
- (e) State the type of congruence between the object ABC, and the final image $A'''B'''C'''$. (2 marks)

- 23** The frequency table below shows the mass in kg of 500 children below 15 years sampled in a children hospital.

Mass	$15 \leq x < 25$	$25 \leq x < 30$	$30 \leq x < 50$	$50 \leq x < 60$
No of children	180	120	150	50

- (a) Draw a histogram to represent the above information. (5 marks)



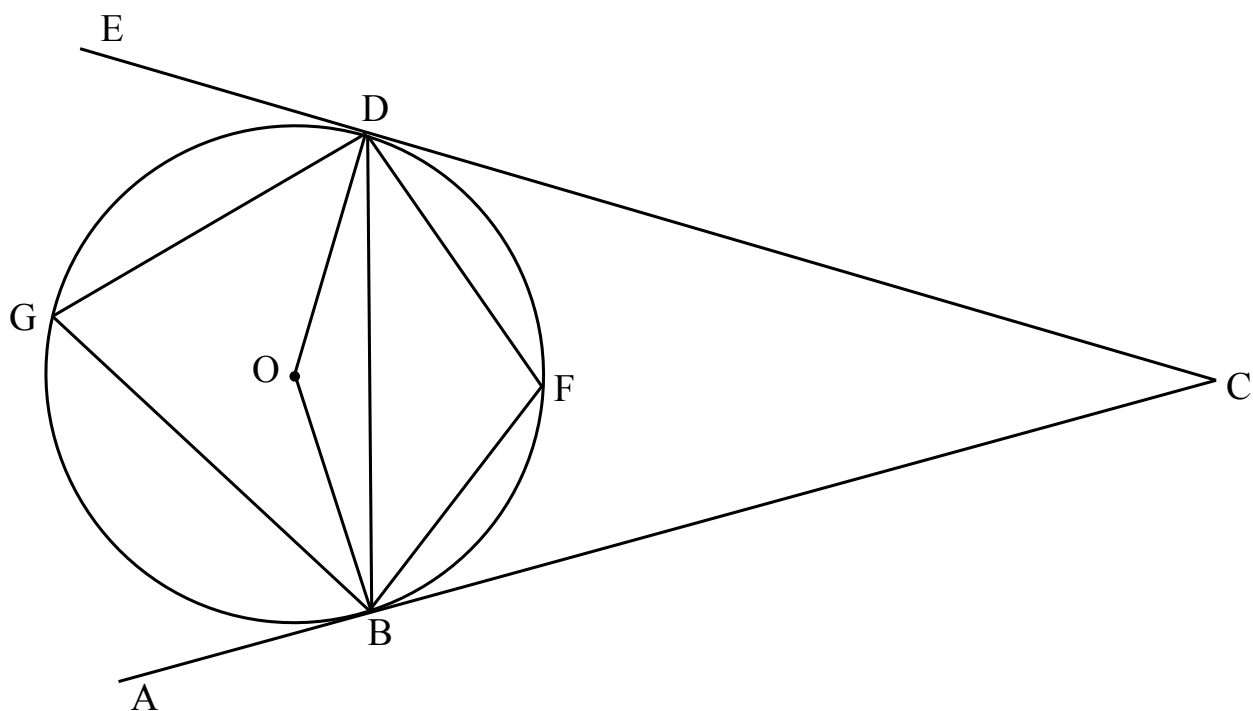
- (b) (i) State the class in which the median mass lies. (1 mark)

- (ii) Draw a vertical line in the histogram showing where the median mass lies. (1 mark)

- (c) On the same axes, draw a frequency polygon. (1 mark)

- (d) Using the histogram, determine the number of children whose masses lie in the range $20 \leq x \leq 40$. (2 marks)

- 24** In the diagram below $\angle EDG = 36^\circ$, $\angle ABG = 42^\circ$ line EDC and ABC are tangents to the circle at D and B respectively.



Calculate by giving reason.

- (a) $\angle DGB$. (2 marks)
- (b) Obtuse $\angle DOB$. (2 marks)
- (c) $\angle GDB$. (2 marks)
- (d) $\angle DCB$. (2 marks)
- (e) $\angle DFB$. (2 marks)