THE ELITES JET

121/2 **MATHEMATICS** **Paper 2**

(Alt. A)

PRE-MOCK

March 2025 – Time: 2½ hours

Name …… Adm No……..…….. Class……..…..…

School……Date…….…....…Sign……..……..….

Instructions to candidates

a) *Write your name, admission number and class in the spaces provided above.*
b) *Write the name of your school, the date and signature.*
c) *This paper consists of **two** sections; **Section I** and **Section II**.*
d) *Answer all the questions in **Section I** and **only five** 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 calculators **and** KNEC Mathematical tables may be used, except where stated otherwise.*
h) ***This paper consists of 16 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.***

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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*

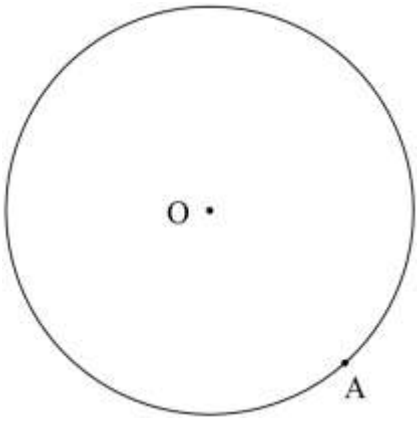
1 Given that $x = 48.5$ cm and $y = 30.2$ cm are both measured correct to the nearest millimeter, calculate the greatest percentage error in $x - y$. (3 marks)

2 Find the value of c for which $2x^2 - 10x + 5 + c$ is a perfect square. (2 marks)

3 Solve the equation $\log_{10}(x - 15) = 2 - \log_{10} x$. (3 marks)

4 Simplify $\frac{10}{\sqrt{5}-2}-\frac{5}{\sqrt{5}}$ without using a calculator giving your answer in the form $a+b\sqrt{c}$ where a, b and c are integers. (3 marks)

5 The figure below is a circle centre O. Point A is on the circle such that AT and BT are tangents to circle at A and B respectively.



Given that angle $ATB = 60^{\circ}$, construct the tangents AT and BT. Measure BT. (4 marks)

6 Make n the subject of the formula $\frac{r}{p} = \frac{m}{\sqrt{n-1}}$. (3 marks)

7 Expand $\left(1-\frac{3}{10}x\right)^5$ in increasing powers of *x*, leaving the coefficients as fractions in their simplest form.

Hence use the first three terms of the expansion to estimate the value of $(0.97)^5$. (3 marks)

8 Grade A rice costing Ksh 250 per kg is mixed with grade B rice costing Ksh 180 per kg. In what ratio must grade A rice be mixed with grade B rice so that a profit of 20% is realized by selling the blend at Ksh 240 per kg. (3 marks)

9 Solve the equation $2\sin^2 x = \cos x + 1$ for $0^\circ \leq x \leq 360^\circ$. (3 marks)

10 Three quantities P, Q and R are such that the square root of P varies directly as Q and inversely as R. Find the percentage change in R, if Q decreases in the ratio 4:5 and P increases by 40%. (3 marks)

11 A circle with centre at $(2,-2)$ passes through the points $A(2,4)$ and $B(8,h)$. Find the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are constants hence determine the value of h. (4 marks)

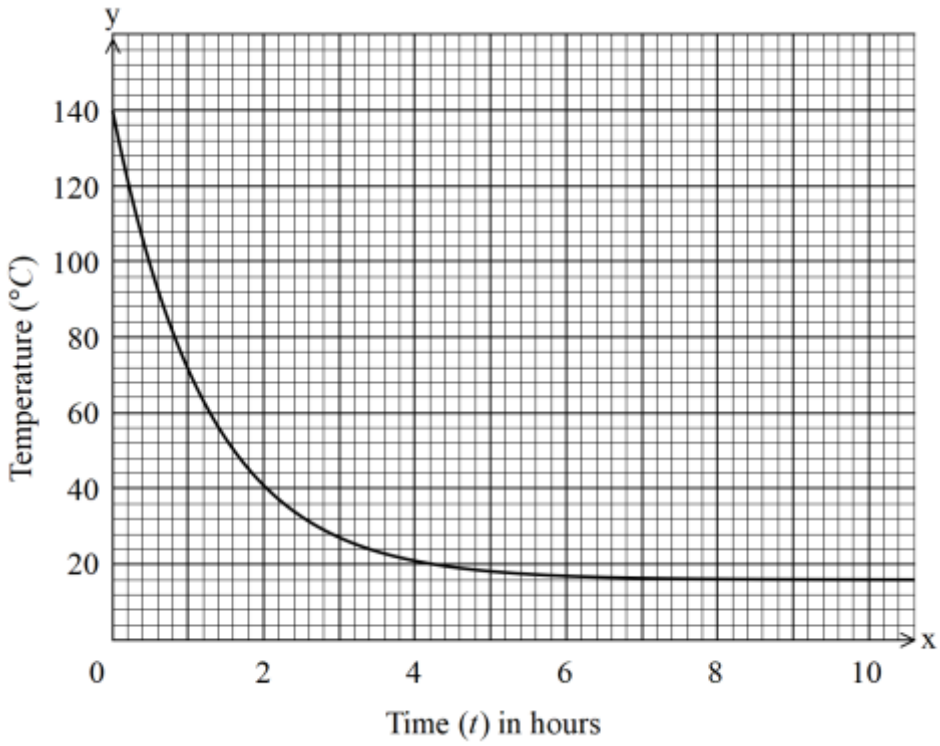
12 Nine students scored some marks in a test. The deviations of the scores from the mean were $5,\ -2,\ 2,\ 1,\ z,\ -3,\ -2,\ -4$ and 0. Given that the mean of the scores was 13, find z and the quartile deviation. (4 marks)

13 The position vectors of A and B are $\mathbf{OA} = \begin{pmatrix} 3 \\ -2 \\ -4 \end{pmatrix}$ and $\mathbf{OB} = \begin{pmatrix} 4 \\ 5 \\ -2 \end{pmatrix}$ respectively. Given that a point X divides **AB** externally in the ratio 3:2, find **AX**. (3 marks)

14 An object of area 12 cm^2 is mapped onto an image of area 144 cm^2 by the transformation matrix $\mathbf{M} = \begin{pmatrix} p & 11 \\ -3 & p-10 \end{pmatrix}$. Find the value of p. (3 marks)

15 The cash price of motocycle is Ksh 80 000. Katana bought the motocycle on hire purchase by paying some amount of deposit followed by 10 equal monthly instalments of Ksh 8 533 each. Given that 2% per month compound interest was charged on the balance, calculate the amount of deposit Katana paid to the nearest shilling. (4 marks)

16 The curve below represents a cooling curve of a substance X.



Calculate the average rate of cooling between $t = 1$ hour and $t = 7$ hours. (2 marks)

SECTION II (50 marks)

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

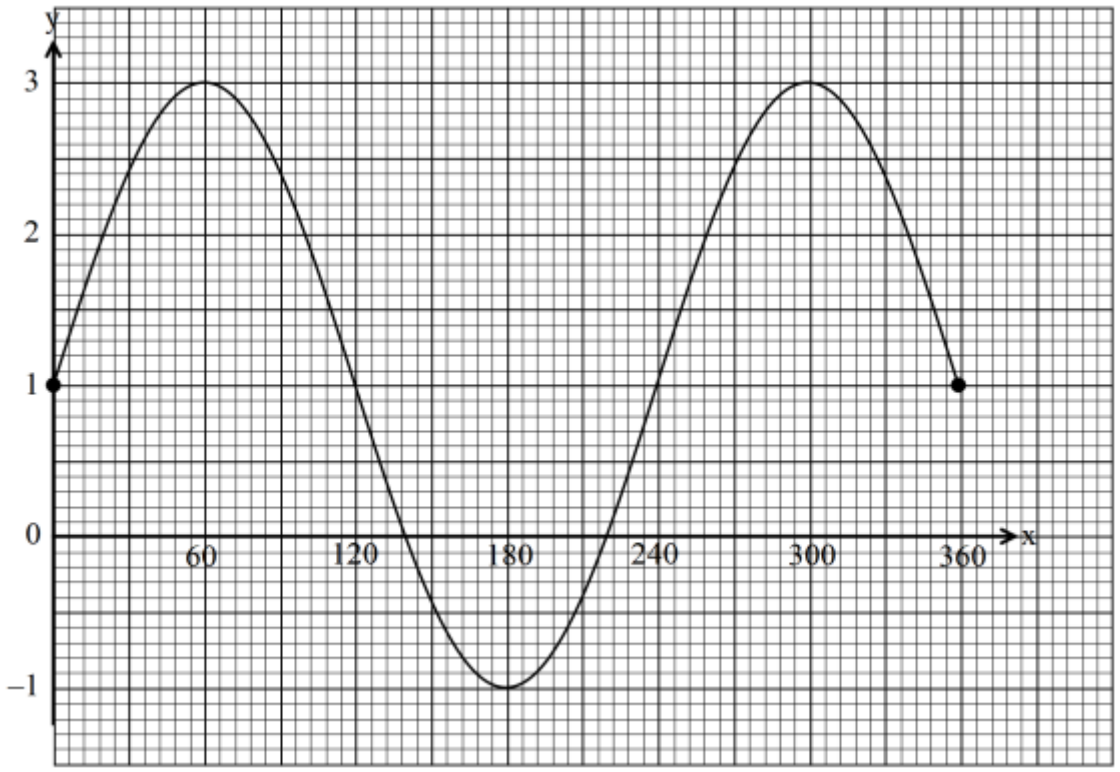
17 The first three terms of an arithmetic progression (A.P) are $\frac{p^2}{6}$, $2p-6$ and p respectively.

(a) Given that the common difference of the A.P is not zero, find the value of p. (4 marks)

(b) Find the 20^{th} term of the A.P. (3 marks)

(c) Calculate the sum of the first 20 terms of the A.P. (3 marks)

18 (a) The graph below represents the wave $y = \mathrm{A} + \mathrm{B}\sin \mathrm{w}x$ in the range $0^\circ \le x \le 360^\circ$.



Determine the values of the constants A, B and w. (3 marks)

(b) Complete the table below correct to 1 decimal place hence draw the curve of $y = 1 - 2\cos x$ for $0^\circ \le x \le 360^\circ$ on the same axes. (3 marks)

x	0	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$1 - 2\cos x$	–1.0		0		2.0			2.7	2.0		0		

(c) Using the graphs solve the equations:

(i) $\mathrm{A} + \mathrm{B}\sin \mathrm{w}x = 0$. (2 marks)

(ii) $1 - 4\cos x = 0$ (2 marks)

19 A form four class has streams A, B, C and D. The streams are distributed as follows with respective percentage of Antimicrobial Resistance (AMR) infection.

Stream	A	B	C	D
No. of students	45	56	64	60
% with AMR	20%	12.5%	25%	10%

(a) A student is chosen at random from the class. Determine the:

(i) Probability that the student is in form 4D. (2 marks)

(ii) Probability that the student is infected with AMR. (2 marks)

(b) Two students are chosen at random from the school. Determine the:

(i) Probability that one of the students is in form 4A while the other is in form 4D. (3 marks)

(ii) Probability that one of the students is in form 4A while the other is in form 4D and both are infected with AMR. (3 marks)

20 The table below shows distribution of marks scored by 50 students in a Mathematics test.

Marks	48 – 52	53 – 57	58 – 62	63 – 67	68 – 72	73 – 77
No. of students	5	12	15	10	6	2

(a) Using an assumed mean of 60, calculate:

(i) Mean mark. (3 marks)

(ii) The standard deviation. (3 marks)

(b) Find the number of students who scored 65 marks and above. (2 marks)

(c) If each student was added 5 marks, determine the:

(i) New mean (1 mark)

(ii) New standard deviation. (1 mark)

21 The following table shows monthly income tax rates for a certain year.

Monthly taxable income in Kenya Shillings	Percentage tax rate in each shilling
0 – 11180	10
11181 – 21714	15
21715 – 32248	20
32249 – 42782	25
42783 and above	30

In a certain month of the year, an employee paid a net tax of Ksh 10 164.80 after getting a tax relief of Ksh 2 400.

(a) Calculate the employee's taxable income that month. (5 marks)

(b) The employee was entitled to a house allowance of Ksh 12 000, a medical allowance of Ksh 6 000 and a commuter allowance of Ksh 3 600. Calculate the employee's basic salary. (2 marks)

(c) Every month, the following deductions were made; Pension Scheme 2% of the basic salary, Union Dues Ksh 1 060 and SHIF Ksh 2 200. Calculate his net monthly salary. (3 marks)

22 Use a ruler and a pair of compasses only for the constructions in this question.

(a) Construct a parallelogram ABCD such that AB = 9 cm, BC = 7 cm and $\angle ABC = 105^\circ$. Measure the length AC. (3 marks)

(b) Construct the locus P inside the parallelogram such that P is equidistant from AB and AD and also equidistant from AD and BC. (3 marks)

(c) Shade the locus Q inside the parallelogram such that Q satisfies the following conditions:

(i) $\angle AQB \leq 120^\circ$

(ii) $\angle AQB$ is an obtuse angle. (4 marks)

23 Three machines A, B and C are set to work together. Machine A working alone takes 6 hours to complete the work while machine B takes 8 hours to complete the work. All the three machines working together take 2 hours to complete the work. All the three machines started working at the same time.

(a) Calculate the time taken by machine C working alone to complete the work. (2 marks)

(b) Twenty minutes later, machine A broke down. Machines B and C continued for another 45 minutes before machine B ran out of fuel and therefore stopped working for 40 minutes while C continued. Machine B resumed working after the 40 minutes. Calculate the:

(i) Fraction of the work left after machine broke down. (3 marks)

(ii) Fraction of the work done by machine C working alone for 40 minutes. (2 marks)

(iii) Total time taken for the work to be completed. (3 marks)

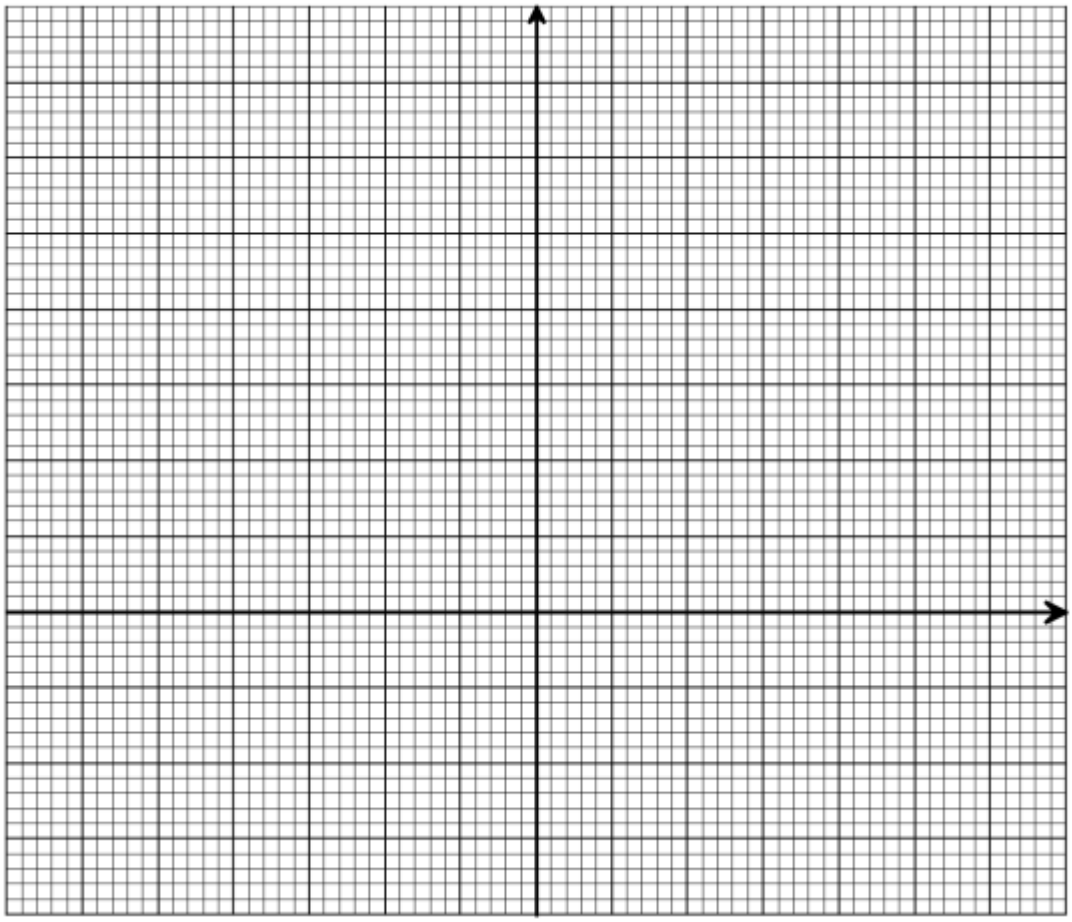
24 The vertices of a triangle ABC are $A(1,-3)$, $B(5,-3)$ and $C(1,-1)$.

(a) Given that triangle ABC is mapped onto triangle $A'B'C'$ by shear y – axis invariant and point $A(1,-3)$ mapped onto point $A'(1,-1)$;

(i) Find the matrix representing the shear. (2 marks)

(ii) Find the coordinates of B' and C', the image of B and C under the shear. (2 marks)

(iii) On the grid provided, draw the triangles ABC and $A'B'C'$. (2 marks)



(b) Triangle $A'B'C'$ is mapped onto triangle $A''B''C''$ by the transformation matrix $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$.

(i) On the same axes, draw the triangle $A''B''C''$. (2 marks)

(ii) Find a single matrix that maps triangle $A''B''C''$ onto triangle ABC. (2 marks)

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