

NAME: _____

ADM NO: _____

CLASS: _____

121/2
MATHEMATICS
PAPER2
TIME: 2½ HOURS

INSTRUCTIONS TO CANDIDATES

- This paper contains two sections: section **A** and section **B**
- 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 electronic calculators and KNEC mathematical tables may be used, except where stated otherwise.

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Section A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section B

17	18	19	20	21	22	23	24	Total

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Grand Total

This paper consists of **15 printed pages**. Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.

SECTION A (50 MARKS)

1. Using logarithms, evaluate correct to 4d.p. (4mks)

$$\left(\frac{25.48 \times 0.0212}{6.159} \right)^{0.8}$$

2. Solve the equation below. (3mks)

$$7^{2x} - 8 \times 7^x + 7 = 0$$

3. Given that $x^2 - 4x + y^2 - 6y + 4 = 0$ is an equation of a circle, determine the centre and radius of the circle. (3 marks)

4. Y varies partly as x and partly as the square of X. When $X = 2$, $Y = 14$ and when $X = 4$, $Y = 44$. Find Y when $X = 6$. **(4 marks)**

- 5.a) Expand $\left(3 + \frac{1}{8}x\right)^4$ in ascending powers of x. **(2 marks)**

- b) Use the first three terms of the expansion above to approximate the value of $(3.025)^4$ to 3 decimal places. **(2 marks)**

6. A student recorded the length of a copper wire as 20.66 cm. If the actual length was 20.6 cm, calculate the fractional error committed. **(3 marks)**

7. If $\frac{\sqrt{14}}{\sqrt{7}-\sqrt{2}} - \frac{\sqrt{14}}{\sqrt{7}+\sqrt{2}} = a\sqrt{7} + b\sqrt{2}$, find the value of a and b where a and b are rational numbers. **(3marks)**

8. Given the matrix $\begin{pmatrix} 5-x & 2 \\ 3x & 4 \end{pmatrix}$ has no inverse, find the value of x. (2 marks)

9. Find the percentage area in calculating the perimeter of a triangle whose dimensions are 5cm, 6.3cm and 7.0cm. **(3mks)**

10. A coffee trader buys two grades of coffee at sh.80 and sh.100 per packet. Find the ratio at which she should mix them so that by selling the mixture at sh.120, a profits of 25% is realized. **(3mks)**

11. Without using a calculator or mathematical tables rationalize and simplify. (3mks)

$$\frac{2}{2\tan 60^\circ + \sqrt{2}} - \frac{2}{2\sin 45^\circ}$$

12.(a) The consecutive terms in a G.P are $3^{x+1/2}$, 9^x and 3^4 . Calculate the value of x. (2mks)

(b) Given that the 5th and 7th terms of the G.P. in (a) above form the first two consecutive terms of an AP. Calculate the sum of the first 10 terms. (2mks)

13. Determine the ratio in which P(11,0) divides AB, where A and B are the point (2,-3) and (17, 2) respectively (2mks)

14. Make x the subject in the formula: (3mks)

$$M = \frac{X-P}{P(1-PX)}$$

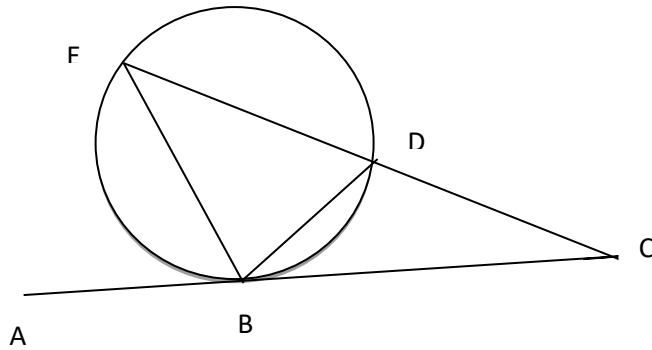
15. Solve for x : $(\log_3 x)^2 - \frac{1}{2} \log_3 x = \frac{3}{2}$ (3mks)

16. Find the longest side of the right-angled triangle whose other sides are;
 $(\sqrt{2} + 1)$ cm and $(\sqrt{2} - 1)$ cm long, leaving your answer in surd form. (3mks)

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SECTION B (50 MARKS) ANSWER ANY 5 QUESTIONS

17. In the figure angle $CBD = 37^\circ$, angle $BCD = 20^\circ$, CDE is a straight line and ABC is a tangent to the circle at B .



- a) Find with reasons
- i) Angle BED . (2 marks)
- ii) Angle ABE (2 marks)
- iii) Angle BDC (2 marks)
- b) With reasons state whether triangle BDC is similar to triangle CBE . **(2 marks)**
- c) Given that the radius of the circle is 2.5 cm find the length of B **(2 marks)**

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18.a) A plane flew from airport X (60°S , 30°E) due North to airport Y (30°N , 30°E) at 180knots. After 20 minutes stop over for fuelling at Y, the plane flew due West to an airport Z (30°N , 15°E) at the same speed.

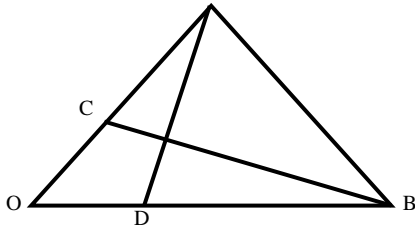
(i) Calculate the total distance covered by the plane in nautical miles **4 marks**

(ii) Calculate the total time taken to complete the journey from X through Y to Z. **(4marks)**

b) P and Q are two towns on the surface of the earth. Their local times differ by $3\frac{3}{4}$ hours. If the longitude of P is 15°E , find two possible longitudes of Q.

(2marks)

19. The diagram given below shows a triangle OAB. $\mathbf{OA} = \mathbf{a}$ and $\mathbf{OB} = \mathbf{b}$. A point C divides OA in the ratio 2:3, D divides OB in the ratio 3:4 and the lines AD and BC meet at E.



a) Find in terms of \mathbf{a} and \mathbf{b} the vectors

i) \mathbf{OC}

(1 mark)

(ii) \mathbf{CB}

(1 mark)

(b) Given that $\mathbf{CE} = m\mathbf{CB}$ and $\mathbf{DE} = n\mathbf{DA}$ where m and n are scalars

(i) Write down two distinct expressions for \mathbf{OE}

(3 marks)

(ii) Hence find the values of m and n

(4 marks)

(iii) Find \vec{OE} in terms of \mathbf{a} and \mathbf{b} only

(1 mk)

20. a) ABCD is a quadrilateral with vertices as follows: \mathbf{A} (3, 1), \mathbf{B} (2, 4), \mathbf{C} (4, 3) and \mathbf{D} (5, 1)

(i) $\mathbf{A'B'C'D'}$ is the image of \mathbf{ABCD} under a transformation whose matrix is $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. On the grid provided draw the quadrilateral \mathbf{ABCD} and its image $\mathbf{A'B'C'D'}$. (3marks)

ii) Describe fully the transformation that maps \mathbf{ABCD} onto $\mathbf{A'B'C'D'}$. (1mark)

b) A transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps $\mathbf{A'B'C'D'}$ onto $\mathbf{A''B''C''D''}$. Plot $\mathbf{A''B''C''D''}$ on the same grid. (3marks)

c) Determine a single matrix transformation that maps $\mathbf{A''B''C''D''}$ onto \mathbf{ABCD} . Describe this transformation fully.

21. Calculate the turning point of the function $y = x^3 - 3x$ and state their nature
Hence sketch the curve. (5mks)

(b) Find the area of each of the two segments of the curve $y = x^3 - 3x$ cut off by the x-axis. (5mks)

22.(a) Using the trapezium rule, estimate the area enclosed by the curve $y = x^2$, the x-axis and the line $x = 5$ and $x = 2$ taking 7 ordinates. **(3 marks)**

(b) Find the exact area.

(3 marks)

(c) Find the % error in using trapezium rule.

(2 marks)

Estimate the area using mid-ordinate rule

2marks

23. The displacement h metres of a particle moving along a straight line after t seconds is given by $h = -2t^3 + \frac{3}{2}t^2 + 3t$

a) Find its initial acceleration if it accelerates uniformly. **(3 marks)**

b) Calculate:

(i) The time when the particle was momentarily at rest **(3 marks)**

(ii) Its displacement by the time it comes to rest momentarily **(2 marks)**

c) Calculate the maximum speed attained **(2 marks)**

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24. The probability of a candidate passing her secondary examination is $\frac{4}{5}$. If she passes the examination the probability of her joining a university is $\frac{2}{3}$. If she fails her examination, the probability of joining a university is $\frac{1}{4}$. If she joins the university the probability of getting a job is $\frac{6}{7}$ and if she does not join the university the probability of getting a job is $\frac{2}{9}$

a) Draw a tree diagram. (2 marks)

b) The probability that she fails her examination (2 marks)

c) Find the probability that she got a job after failing her secondary examination (2 marks)

d) The probability that she joins university . (2 marks)

e) The probability that she did not get a job (2 marks)