

Name _____ Adm. No: _____ Class: _____

Index No: _____

KASSU JET EXAMINATION

Kenya Certificate of Secondary Education

121/1

MATHEMATICS

PAPER I

SEPTEMBER 2021

2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

1. Write your name, admission number, class and index number.
2. The paper contains two sections: Section I and II
3. Answer ALL questions in section I and ANY FIVE questions from section II.
4. All working and answers must be written on the question paper in the spaces provided below each question.
5. Marks may be awarded for correct working even if the answer is wrong.
6. Negligent and untidy work will be penalized.
7. Non-programmable silent electronic calculators and four figure mathematical tables are allowed for use.
8. This paper consists of printed pages. Candidates should check the question paper to ensure that all the pages are printed indicated and no questions are missing.

FOR EXAMINER'S USE ONLY

SECTION 1

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 A 50 MARKS

1. Evaluate $\frac{3}{4} + 1\frac{5}{7} \div \frac{4}{7}$ of $2\frac{1}{3}$ (3marks)

$$\left(1\frac{3}{7} - \frac{5}{8}\right) \times \frac{2}{3}$$

2. Solve for x in $\sin(x - 15) - \cos(x + 5) = 0$ (2marks)

3. The LCM of two numbers is 328,600 and the GCD is 20. If one of the numbers is 1240, use prime factorization method, find the other number. (3 marks)

4. A spherical solid lead of diameter 12cm weighs 6.4kg. How much would a similar solid of a diameter 10cm weigh? (3marks)

5. Without using a calculator or mathematical tables evaluate,

$$\frac{\left(\frac{1}{81}\right)^{\frac{1}{4}} \times (256)^{\frac{1}{2}} \times 3^5}{(729)^{-\frac{1}{3}} \times 72^2} \quad (3\text{marks})$$

6. On arrival to Kenya a Canadian tourist exchanged his Canadian dollars for Ksh 199 690. Given that the currency exchange rate was 1 Canadian dollar = Ksh 52.55 and that the bank charged him 5% commission, find the number of dollars he exchanged. (3 marks)

7. By using completing square method, solve for x in $4x^2 - 3x - 6 = 0$ (3marks)

8. Simplify the following. (3 Marks)

$$\frac{2x-4}{12-3x^2} - \frac{1}{3x+6}$$

9. The matrix $\begin{bmatrix} x & 1 \\ x+5 & x+5 \end{bmatrix}$ maps a triangle ABC onto a straight line. Determine the possible values of x . (3 marks)

10. Using the tables of squares, square roots and reciprocal $3.0452 \times \frac{6}{\sqrt{49.24}}$ (4marks)

11. Find the percentage error in the quotient in $9.16\text{cm} \div 2.0\text{cm}$ (4marks)

12. The position vectors $\mathbf{a} = \begin{pmatrix} -1 \\ 5 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -8 \\ 7 \\ 13 \end{pmatrix}$. Find the scalars S and T such that $S\mathbf{a} + T\mathbf{b} = \mathbf{c}$ (3 marks)

13. The following data represents the enrolment of students in 12 colleges

564	553	566	554	563	563
657	556	553	554	651	559

Calculate the quartile deviation

(3 marks)

14. The density of a sphere of diameter p cm is 2.68 g/cm^3 and that of another sphere is diameter Q cm is 14.23 g/cm^3 . Determine the volume of sphere Q that would have the same mass as 80cm^3 . (3marks)

15. Solve and represent the integral values of the linear inequalities given below on a number line.

$$\frac{4}{3} - \frac{x-2}{x} \geq 1, \quad -2 - \frac{2}{3}x < x + 8 \quad (3\text{marks})$$

16. Find the equation of the normal to the curve $y = x^3 - 2x^2 + 3x - 1$ at the point $(2, 5)$
(3marks)

SECTION B (50 MARKS)

17. A straight line L_1 has its x-intercept and y-intercept as -6 and 4 respectively.

a) Write its equation in the form $ax + by + c = 0$ where a, b, and c are integers (3marks)

b) Another line L_2 which is parallel to L_1 in (a) above passes through $(2, 3k)$ and $(-k, 8)$. Find the value of k. (2marks)

c) Find the equation of the perpendicular bisector to the line L_1 (3marks)

d) Calculate the angle which L_1 makes with the x-axis (2marks)

18. A man spent $\frac{1}{9}$ of his salary on food and $\frac{1}{4}$ of the remainder on electricity and water bills. He paid fees with 20% of his salary and invested 16% of what was left into a business. After taking a game drive on which he spent Ksh 2000, he saved Ksh 5350. Calculate:
- (a) His total monthly earnings. (4 marks)

(b) How much he spent on fees. (2 marks)

(c) How much he invested. (2 marks)

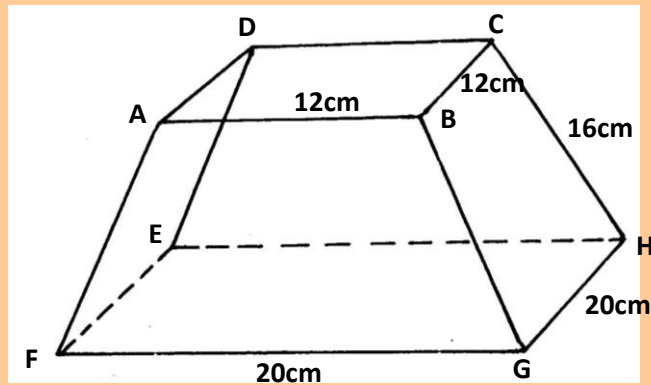
(d) The percentage of the salary saved. (2 marks)

19. Every Sunday Alex drives a distance of 80km on a bearing of 074° to pick up his brother John to go to church. The church is 75km from John's house on a bearing of $S50^{\circ}E$. After church they drive a distance of 100km on a bearing of 260° to check on their father before Alex drives to John's home to drop him off then proceeds to his house.

- (a) Using a scale of 1cm to represent 10km, show the relative positions of these places. (4 marks)

- (b) Use your diagram to determine:
- (i) the true bearing of Alex's home from their father's house. (1 mark)
 - (ii) the compass bearing of the father's home from John's home. (1 mark)
 - (iii) the distance between John's home and the father's home. (2 marks)
 - (iv) the total distance Alex travels every Sunday. (2 marks)

20. The figure below shows solid frustum of a pyramid with a square top of side 12cm and a square base of side 20cm. The slant edge of the frustum is 16cm.



a) Calculate the total surface area of the frustum (4marks)

b) Calculate the volume of the solid frustum. (4marks)

c) Calculate the angle between the planes **BCHG** and the base **EFGH**. (2marks)

21. (a) A radio station tower was built in two sections. From a point 870m from the base of the tower, the angle of elevation of the top of the first section is 25° and the angle of elevation of the top of the second section is 40° . What is the height of the top section of the tower? (5marks)

(b) Two vertical poles on horizontal ground are 60m apart. The shorter pole is 3m high. The angle of depression of the top of the shorter pole from the top of the longer pole is 20° . Using scale drawing, find the length of the longer pole. (5 marks)

22. Coast bus left Nairobi at 8.00a.m. and traveled towards Mombasa at an average speed of 80km/hr. at 8.30am, Lamu bus left Mombasa towards Nairobi at an average speed of 120km/h. Given that the distance between Nairobi and Mombasa is 400km; determine:

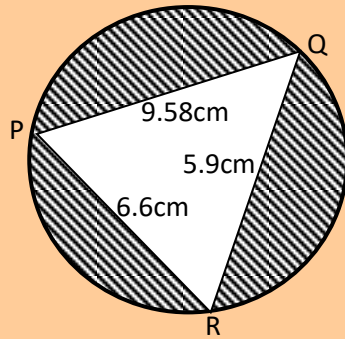
(i) The time Lamu Bus arrived in Nairobi. (2marks)

(ii) The time the two buses met. (4marks)

(iii) The distance from Nairobi to the point where the buses met. (2marks)

(iv) How far Coast Bus is from Mombasa when Lamu bus arrives in Nairobi. (2marks)

23. Triangle PQR is inscribed in the circle. $PQ = 7.8\text{cm}$, $PR = 6.6\text{cm}$ and $QR = 5.9\text{cm}$.



Find;
(a) size of angle QPR (3 Marks)

(b) the radius of the circle. (3 Marks)

(c) the area of the shaded region. (4Marks)

24. (a) Find the stationary points of the curve to (1 d.p) (6 marks)
- $$y = \frac{(x+2)(x-1)}{(x-4)^{-1}}$$

- (b) Find the x and y intercepts of the curve above. (2 marks)

- (c) Sketch the curve. (2 marks)

Name..... Adm No.....Class.....

121/2

MATHEMATICS

PAPER 2

2 ½ HOURS

SEPTEMBER 2021

KASSU JOINT EVALUATION TEST (J.E.T)
Kenya Certificate of Secondary Education (K.C.S.E)

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SECTION A 50 MARKS

1. Use logarithm tables to evaluate; $\sqrt[3]{\frac{648 \times 0.0079}{(968 - 94) \div 0.0046}}$ (3mks)

2. The middle digit of a number between 100 and 1000 is zero, and the sum of the other digits is 11. If the digits are reversed the number so formed exceeds the original by 495. Find the number. (3 mks)

3. Without using mathematical tables or a calculator evaluate

$$\sqrt{\frac{0.3 - 0.098 \div (0.84 - 0.14)}{(0.28 + 0.12) \div 0.8 \times 0.5}}$$

Leaving the answer as a decimal (3 marks)

4. Expand $(0.07)^5$ using binomial theorem giving your answer to four significant figures

(3marks)

5. Solve for θ in the equation $\sin(3\theta + 120^\circ) = \frac{\sqrt{3}}{2}$ in the range $0 \leq \theta \leq 180^\circ$. (3 mks)

6. Rationalize the denominator leaving your answer in the form $a + b\sqrt{c}$ where a , b and c are

constants $\frac{5 - 2\sqrt{3}}{2 + 3\sqrt{3}}$

(3marks)

7. A farmer bought a machine at a current price of Ksh 224,000. If the depreciation rate is 5% in every 3 months. Calculate the sum of its value in 3 years ago and 3 years' time. (3mks)

8. Without using logarithm table or calculators, find the value of p in the equation.
 $\log n^3 + \log 4n = 10 \log 2 - \log (2^p/8)$ (3mks)

9. Using mid-ordinates rules, estimate the area under the curve $y = \frac{1}{2}x^2 - 2$, using six strips between $x=2$ and $x=8$ and x-axis (3mks)

10. (a) Using a pair of compass and a ruler only Construct a triangle PQR in which $PQ=QR=4\text{cm}$ and angle $QPR=30^\circ$. (2mks)

(b) A point T is always on the same side of PQ as R and angle $PRQ=\text{angle } PTQ$. Construct the locus of T and describe it. (2mks)

11. R is partly constant and partly varies as the square of q. when $R = 5$, $q = 3$ and $R = 21$, when $q = 5$. Find the value of R when $q = 3$. (3mks)

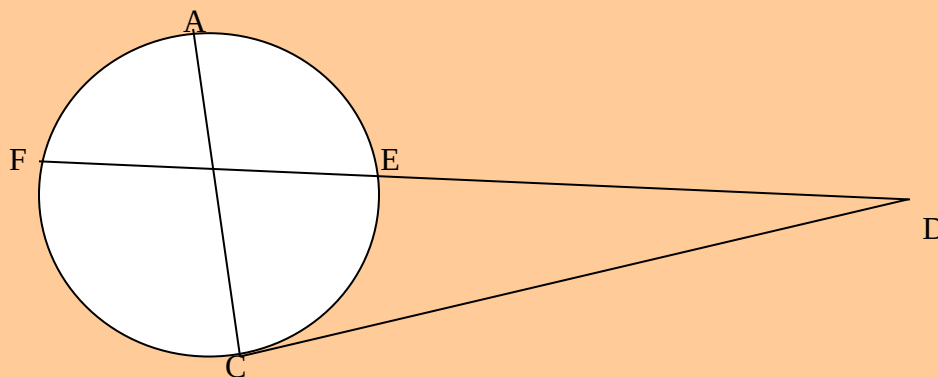
12. The first, the third and the seventh term of an increasing arithmetic progression are three consecutive terms of a geometric progression. If the first term of the arithmetic progression is 10, find the common difference of the arithmetic progression (3mks)

13. The equation of a circle is $x^2 - 8x + y^2 + 12y + 16 = 0$

Determine the coordinates of the Centre of the circle and its radius.

(3 Marks)

14.



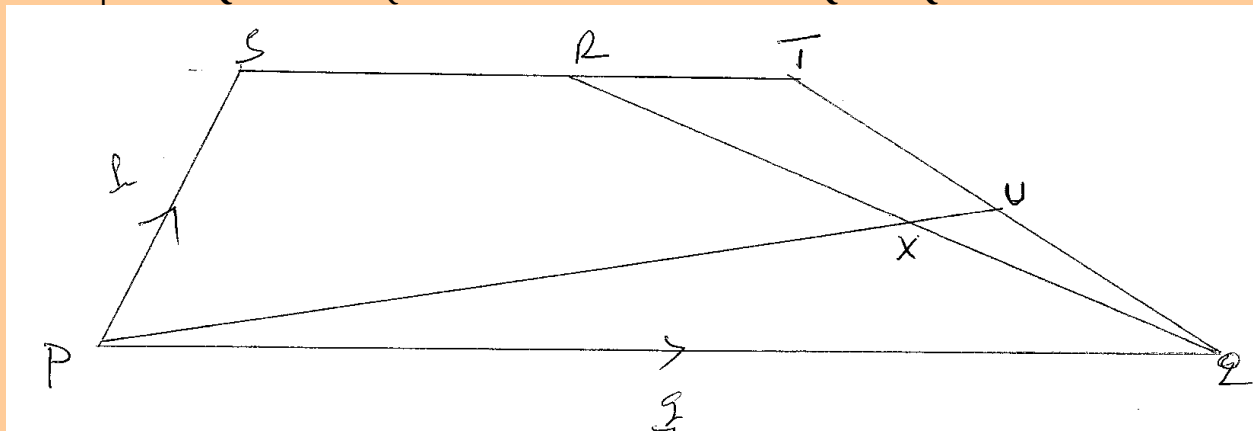
In the diagram above CD is a tangent to the circle at C. AC and FD intersect at B. FED is a straight line. Given that CD = 10 cm, AB = 2 cm AC = 8 cm, FB = 3 cm. Find the length ED.
4mks

15. The cost of 2 brands of coffee A and B per kilogram are 59.40 and Sh.72 respectively. The two brands are mixed in the ratio x:y and sold at a profit of 20% above the cost. If the selling price per kilogram mixture is Ksh.72. find the value of x and y
(3mks)

16. Evaluate $\int_{-1}^3 \frac{2x^3 - 3x^2 - 8x + 12}{x^2 - 4} dx$ (3mks)

SECTION B 50 MARKS

17. In the trapezium shown below $\overrightarrow{PQ} = 3\overrightarrow{ST}$. T divides SR in the ratio 4 : 1 and U is the midpoint of QT. PU and QR intersect at X. $PX = hPU$ and $QX = kQR$.



Given that $PQ = \mathbf{q}$ and $PS = \mathbf{p}$

- | | |
|---|--------|
| (a) Express QR in terms of $\mathbf{p}$ and $\mathbf{q}$ | (1mk) |
| (b) Express PX in terms of $\mathbf{p}$, $\mathbf{q}$ and h. | (2mks) |
| (c) Express PX in terms of $\mathbf{p}$, $\mathbf{q}$ and k. | (3mks) |
| (d) Hence; obtains the values of h and k. | (3mks) |
| (e) Determine the ratio in which X divides QR. | (1mk) |

18. The table below shows the distribution of marks of 40 candidates in a test

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	2	2	3	x	12	5	2	3	1	1

(a)(i) Find the value of x

(1mk)

(ii) State the modal class

(1mk)

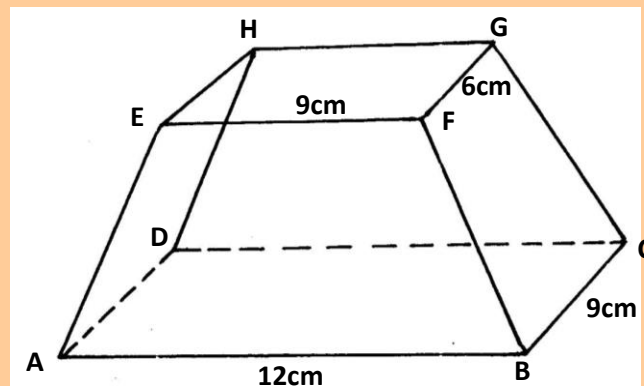
(iii) Calculate the median

(4mks)

(iv) Calculate the mean.

(4marks)

19. The figure below is a frustum of a rectangular pyramid with $AB=12\text{CM}$, $EF=8\text{CM}$, $BC=9\text{CM}$ and height of 6 CM



Calculate:

- | | |
|---|---------|
| a) the full height of the pyramid | 2 marks |
| b) angle that the plane ABFE makes with the base ABCD | 2marks |
| c) angle that AG makes with the base ABCD | 3marks |
| d) angle that AC makes with line AE | 1mark |
| e) angle that plane BCGF makes with the base ABCD | 2marks |

20. (a) A point a (35° N, 40° W) and b (40° S, 40° W), Calculate the distance between A and B in Kilometers. Take earth radius o be 6370 km. answer to 1 d.p. (3mks)

(b) A and B are points on latitude 70° C. Their longitudes are 62° W and 118° E respectively. Find the distance from A to B along a parallel of latitude. (4mks)

- (c) Peter was in Mombasa 39°E and Mary was in Banju 17°W . Calculate the time difference between the two. (3mks)

21. ABCD is a quadrilateral with vertices as follows: **A** (3, 1), **B** (2, 4) **C** (4, 3) and **D** (5, 1)

- (a) (i) On the grid provided draw the quadrilateral **ABCD** and the image **A'B'C'D'** under a transformation

With matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$. Find the co-ordinates of **A'B'C'D'** (3mks)

Describe the transformation that maps **ABCD** onto **A'B'C'D'** fully (1mk)

(b) A transformation represented by the matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ maps **A'B'C'D'** onto **A''B''C''D''** find the co-ordinates of **A''B''C''D''**. Plot **A''B''C''D''** on the same grid. (3mks)

(c) Determine a single transformation that maps **A''B''C''D''** onto **ABCD**. Describe this transformation fully. (3mks)

22. The table below shows the income tax rates in Kenya.

Income in K£ per month	Rate in Ksh / K£
1 - 325	2
326 - 975	3
976 - 1300	5
1301 - 1625	6
Over 1625	7.5

(a) Mr. Sigei is a public servant who lives in a government house and pays a nominal rent of Ksh. 1220 per month. He earns a basic salary of Ksh. 24,800 and taxable allowances of Ksh. 13,380 per month. He is entitled to a monthly tax relief of Ksh. 1120. Calculate his monthly

i) Taxable income in K£. (2mks)

ii) Gross tax.

(3mks)

iii) Tax due

(2mks)

(b) Apart from income tax, the following monthly deductions are made from his salary.

i) HELB loan repayment Ksh. 2400

ii) NHIF Ksh 320

iii) 2% basic salary as union dues.

Calculate Mr. Sigei's monthly net salary.

(3mks)

23. An airline has to fly 1000 passengers and 35000 kg of luggage from Nairobi to Kampala.

Two types of aircrafts are available. Type A takes 100 passengers and 2000 kg of luggage.

Type B takes 60 passengers and 3000 kg of luggage. The airline must not use more than 16 aircrafts altogether.

(a) if the airline hires x type A aircrafts and y type B aircrafts, write down 3 inequalities to represent the information above.

(3mks)

(b) Draw the inequalities on a grid.

(3mks)

(c) Find the minimum number of aircrafts the airline could use. (1mk)

(d) If the cost of hiring charges for each aircraft is sh 100,000 and sh 120,000 for type A and b respectively, find:

(i) The number of planes of each type that should minimize the cost (2mks)

(ii) Minimum cost (1mk)

24. In a mathematics test, the probability of 3 students, Kamau, Otieno and Mwala passing are $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{6}$ respectively

(a) Draw a tree diagram to represent this information (3 marks)

(b) Use the tree diagram to find the probability that:

(i) All the three students will fail (2 marks)

(ii) At least two students will pass. (3 marks)

(iii) Only one student will pass (2 marks)