

Name: Index No.:

School:..... Admission No:

Date:

Sign:

121/2
MATHEMATICS
Paper 2
September 2021
Time: 2½ Hours

BURAMU 2 JOINT EXAMINATIONS
The Kenya National Examinations Council

121/2
MATHEMATICS PAPER 2
September 2021
Time: 2½ Hours

Instructions to candidates

1. Write your name, admission number and class in the spaces provided above.
2. The paper contains two sections: **Section I** and **Section II**.
3. Answer **ALL** the 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 slovenly work will be penalized.
7. Non-programmable silent electronic calculators and mathematical tables are allowed for use.

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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This booklet contains 15 printed pages. Please confirm that all the pages exist and are properly printed before starting the exam.

1. a) Write down the expansion of $\left(1 + \frac{1}{4}x\right)^4$ leaving your answer to 3 significant figure (1 marks)

b) Use it to find the value of 1.025^4 leaving your answer to 3 significant figure (2 marks)

2. Solve the equations (4marks)

$$x + y = 17$$

$$xy - 5x = 32$$

3. Omolo bought a new car for sh. 800 000. After 5 years, he sold the car at sh. 480 000. Calculate the annual rate of depreciation of the car as a percentage (3 marks)

4. A box contains 5 red, 3 yellow and 12 blue biro pens. Two biro pens are picked at random without replacement. Find the probability that only one of the biro pens picked is blue

(3 marks)

5. Evaluate $\int_{-2}^3 (2x - 4) dx$

(3 marks)

6. A circle which passes through the point (3,-1) has its centre at (5, -1). Determine the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are constants

(3 marks)

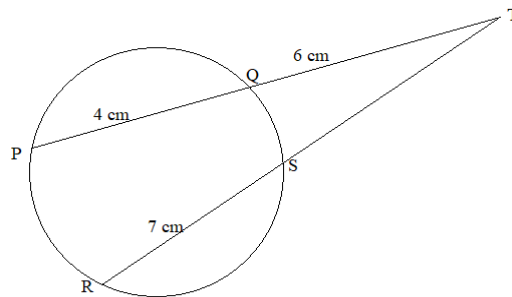
7. Two grades of coffee one costing sh. 42 per kilogram and the other costing sh. 47 per kilogram are to be mixed in order to produce a blend worth sh. 46 per kilogram. In what proportion should they be mixed

(3 marks)

8. Solve for n in the equation (3 marks)

$$\frac{2}{3}\log x^4 - 2\log\sqrt[3]{x} = n\log x$$

9. In the figure below, chords PQ and RS intersect externally at T



- Given that $PQ = 4\text{ cm}$, $QT = 6\text{ cm}$ and $RS = 7\text{ cm}$, find RT (4 marks)

10. A pyramid block has a square base whose side is exactly 7.5 cm . Its height measured to the nearest millimetre is 3.5 cm . find the percentage error in calculating its volume correct to 3 decimal places (3 marks)

11. Solve without using tables or calculators, (3 marks)

$$\frac{\sin 480^\circ - \tan 225^\circ}{\tan 45^\circ - \cos(-330)^\circ}$$

12. Make m the subject of the formula (3 marks)

$$V = \sqrt{\frac{a^2 - t^2}{\frac{1}{m^2} + k}}$$

13. Object A of the area 10cm^2 is mapped onto its image B of area 60cm^2 by a transformation whose matrix is given by $P = \begin{pmatrix} x & 4 \\ 3 & x + 3 \end{pmatrix}$. Find the possible values of x (4 marks)

14. Solve $2\sin(2x - 10)^\circ = \sqrt{3}$ for $0^\circ \leq x \leq 360^\circ$ (3 marks)

1

15. Machine A can do a piece of work in 6 hours while machine B can do the same work in 9 hours. The machines started working together at the same time and after 3 hours machine A broke down and machine B did the rest of the work. Find how long machine B took to do the rest of the work (4 marks)

16. The following is the weight of some form one students in a school

30, 35, 48, 39, 41, 45, 42, 43, 49, 47

Find

a) Mean (1 mark)

b) the quartile deviation (3 marks)

17. Three quantities R, S and T are such that R varies directly as S and inversely as the square root of T.

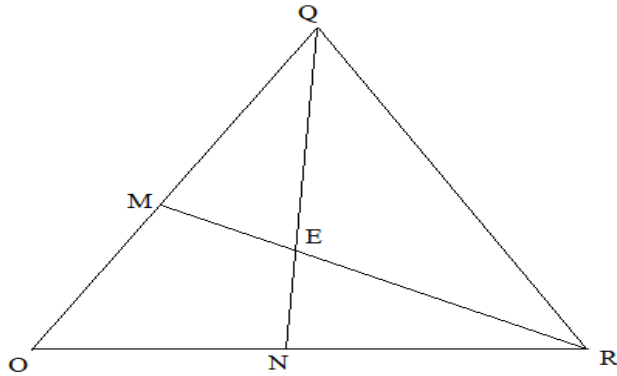
a) Given that $R = 480$ when $S = 150$ and $T = 25$, write the equation connecting R, S and T (4 marks)

b) Find;

i) The value of R when $S = 360$ and $T = 2.25$ (2 marks)

ii) The percentage change in R if S is increased by 5% and T decreased by 15.36% (4 marks)

18. In the figure below $\mathbf{OQ} = \mathbf{q}$ and $\mathbf{OR} = \mathbf{r}$. point M divides \mathbf{OQ} in the ration 1:2 and N divides \mathbf{OR} in the ratio 3:4. Lines \mathbf{MR} and \mathbf{NQ} intersect at E

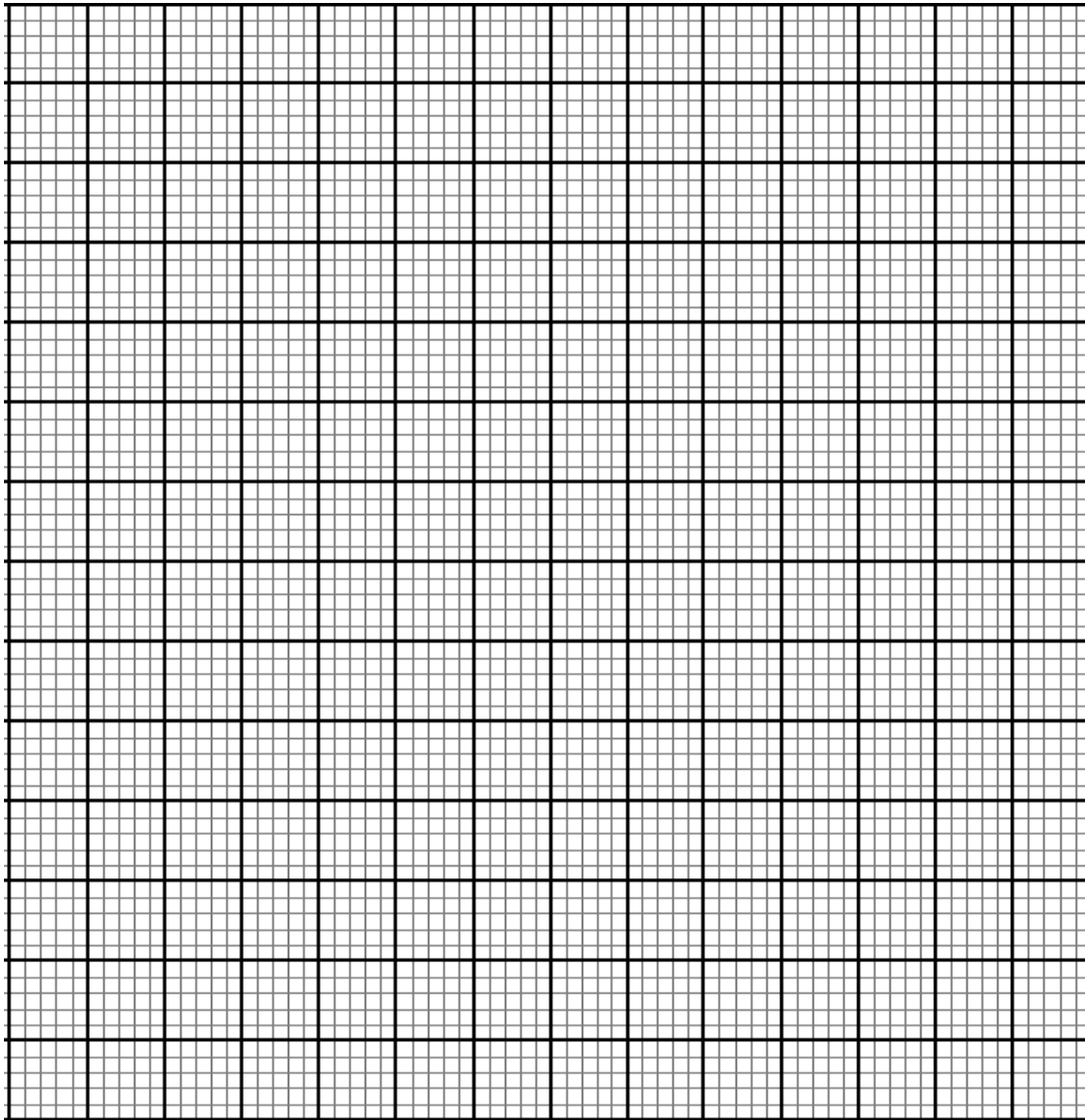


- a) Express in terms of \mathbf{q} and \mathbf{r}
- i) \mathbf{MR} (1 mark)
 - ii) \mathbf{NQ} (1 mark)
- b) If $\mathbf{ME} = s \mathbf{MR}$ and $\mathbf{NE} = t \mathbf{NQ}$, express \mathbf{OE} in terms of;
- i) \mathbf{r} , \mathbf{q} and s (1 mark)
 - ii) \mathbf{r} , \mathbf{q} and t (1 mark)
- c) find the value of s and t using the results in b) above (4 marks)
- d) show that M, E and R are collinear (2 marks)

19. PQRS is a rectangle with vertices P(0,0), Q(2,0), R(3,2) and S(1,2). P'Q'R'S' is the image of PQRS under transformation $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

a) i) Find the coordinates of P'Q'R'S' (2 marks)

ii) on the grid provided draw PQRS and P'Q'R'S' (2 marks)



b) i) Find $P''Q''R''S''$ the image of $P'Q'R'S'$ under the transformation matrix $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$. (2 marks)

ii) on the same grid draw $P''Q''R''S''$ (1 mark)

c) find the single transformation that maps $P''Q''R''S''$ onto PQRS (3 marks)

20. The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r

a) Express r in term of a (3 marks)

b) Given that the sum of the three terms is 14;

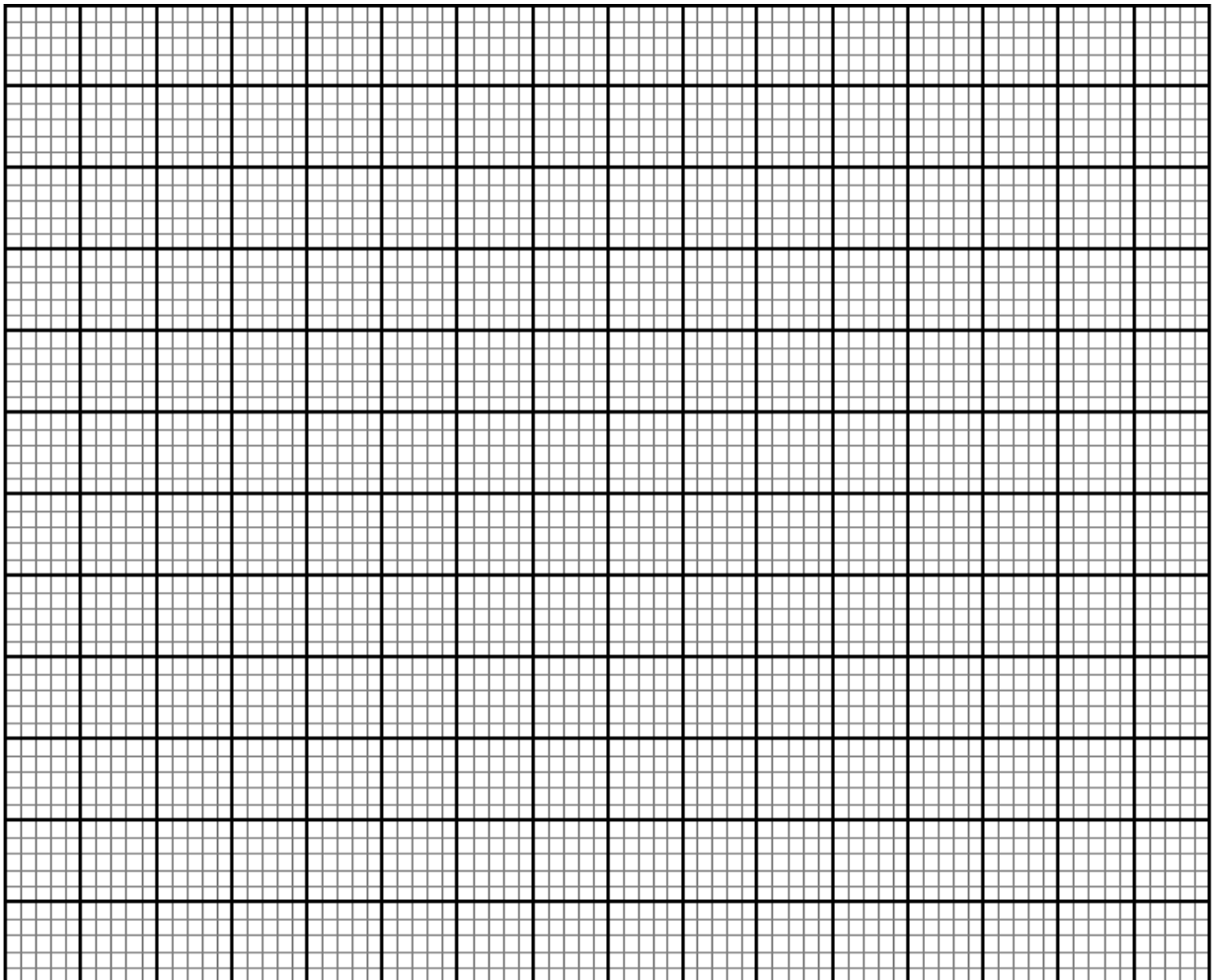
i) Find the values of a and r hence write down two possible sequences each upto 4th term (5 marks)

ii) Find the product of the 50th terms of the two sequences (2 marks)

21. Owiti makes two types of dresses; A and B. He takes 3 hours to make one pair of type A dress and 4 hours to make one pair of type B dress. He works for a maximum of 120 hours to make x pairs of Type A and y pairs of type B. It costs him sh. 400 to make a pair of type A and sh. 150 to make a pair of type B. His total cost does not exceed sh. 9000. He must make at least 8 pairs of type A and more than 12 pairs of type B

a) Write down four inequalities representing the above information (4 marks)

b) Draw the inequalities and shade the unwanted region (3 marks)

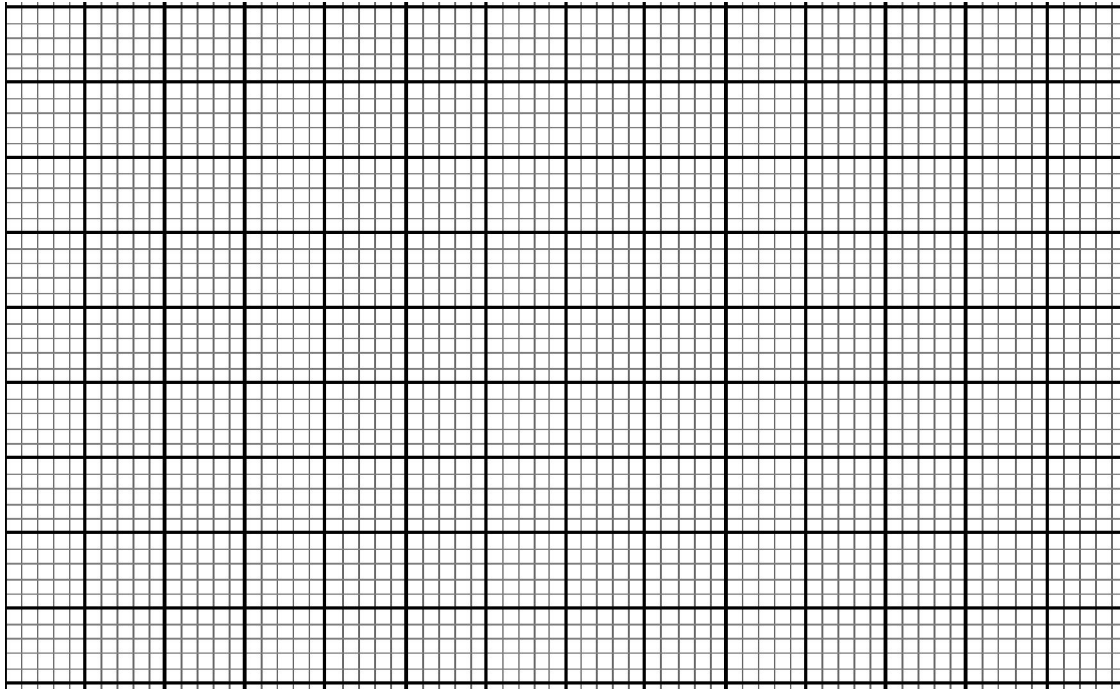


c) Owiti makes a profit of sh. 40 on each pair of type A and sh.70 on each pair of type B dresses. Use the graph in part (b) above to determine the maximum possible profit he makes (3 marks)

22. Fill the table below for the graph of $y = 2x^3 + x^2 - 5x + 2$ (2 marks)

x	-3	-2	-1	0	1	2	3
y							

a) Draw the graph of $y = 2x^3 + x^2 - 5x + 2$ for the interval $-3 \leq x \leq 3$ on the grid provided below (scale y-axis: 1 cm rep 10 units, x-axis: 1 cm rep 0.5 units) (3 marks)



b) Use your graph to solve the equations

i) $2x^3 + x^2 - 5x + 2 = 0$ (1 mark)

ii) $2x^3 + x^2 - 11x - 10 = 0$ (3 marks)

c) Calculate the acute angle the line in b ii) above makes with the y-axis (1 mark)

23. a) Using a ruler and a pair of compasses only, construct a parallelogram ABCD such that $AB = 7\text{cm}$, $BC = 5\text{cm}$ and $\angle ABC = 120^\circ$ (3marks)

b) On the figure above construct

i) locus of points P that are equidistant from A and B (1mark)

ii) locus of points R that are equidistant from lines DA and BA (1mark)

iii) locus of point Q such that $AQ = 3.5\text{ cm}$ (1mark)

c) Locate and shade a region T inside the parallelogram such that $AT \leq BT$, $\angle DAT \leq \angle BAT$ and $AT \geq 3.5\text{ cm}$ (1 mark)

d) locate a point S above AB such that $\angle ASB = 60^\circ$ and S is always 3.2 cm from line AB (3 marks)

24. An aircraft leaves town P($30^{\circ}\text{S}, 17^{\circ}\text{E}$) and moves directly northwards to Q($60^{\circ}\text{N}, 17^{\circ}\text{E}$). It then moved at an average speed of 300 knots for 8 hours westwards to town R.

Determine;

a) The distance PQ in nautical miles (3 marks)

b) The position of town R (3marks)

c) The local time at R if the local time at Q is 3:12pm (2 marks)

d) The total distance moved from P to R in kilometres. Take 1 nm= 1.853km (2 marks)