121/1
MATHEMATICS
PAPER 1
2½ HRS

MANG'U HIGH SCHOOL
MOCK EXAM

INSTRUCTIONS TO CANDIDATES

1. Write your name and Index Number in the spaces provided above.
2. Sign and write the date of examination in the spaces provided above.
3. The paper contains **TWO** sections **1** and **11**.
4. Answer **ALL** the questions in **Sections 1** and any **five** in **Section 11**.
5. Answers and working must be written on the question paper in the spaces provided below each question.
6. **Show all the steps in your calculation, giving your answers at each stage in the spaces below each question.**
7. Non-programmable silent electronic calculators and KNEC mathematical tables may be used, except where stated otherwise.

For Examiner's only
Section 1

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

Section 11

17	18	19	20	21	22	23	24	Total

Grand Total

The paper consists of 6 printed pages.
Candidates should check to see that no page is missing.

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SECTION 1 (50MARKS)

Attempt **All** questions in this section

1. Simplify $\left(\frac{a+b}{a-b}-1\right)^2 \div \left(1-\frac{a-b}{a+b}\right)^2$ (3 marks)

2. Find the value of p and q if the line $2p + 6x - 4y = 0$ passes through the point (6, 2) and is parallel to the line $3qx - 6y + 21 = 0$. (3 marks)

3. Use logarithms to evaluate to 4 decimal places $\dfrac{1.568^3 \times 3.472}{\sqrt{(5.828 \times 0.03628)}}$ (4 marks)

4. The figure below shows a wire frame for a lampshade. PQRSTU and ABCDEF are circular and of radius 14cm and 22cm respectively.
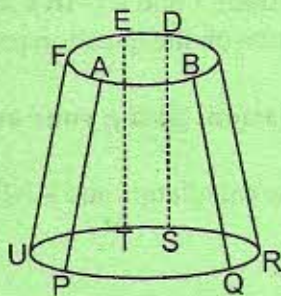
The perpendicular height of the lampshade is 15cm. The 6 struts PA, QB, RC, SD, TE and UF are of equal lengths. Calculate the length of wire required for the frame. Leave your answer in the form a + b. (4 marks)

5. If find $\dfrac{x^h}{y^{\frac{2}{3}}} \div \dfrac{y^k}{yx^3} = x^3 y^{-4}$, find h + k. (3 marks)

6. In the figure below AB = AD = DE, and BC = BD. If $\angle BCD = 35^0$, find the angle marked **a**. (2 marks)

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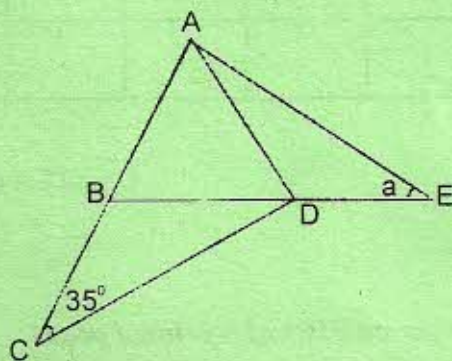
7. A house agent's commission on the sale of a house is 4% of the first Ksh. 70,000 on the selling price and $1\frac{1}{2}\%$ of the remainder.
   a) Calculate the agent's commission on a house selling for Ksh. 150,000. (2 marks)

   b) If the selling price is increased by 20%, calculate the percentage increase in the agent's commission. (2 marks)

8. If the sum of the roots of $x^2 - (c + 1)x + 2(c - 1) = 0$ is three quarters of their product, find the value of c and the roots of the equation. (3 marks)

9. Without using a calculator or mathematical tables, evaluate. (2 marks)

$$\left(\sqrt{5} - \sqrt{3}\right)^8 \left(\sqrt{5} + \sqrt{3}\right)^8$$

10. When the numerator of the fraction $\frac{p}{q}$ is increased in the ratio 3:1 and the denominator is decreased in the ratio 2:3, the resulting fraction is $\frac{27}{28}$. Find the ratio of p:q in its simplest form. (3 marks)

11. The figure below shows three circular arcs touching each other at A, B and C. The radii of the arcs AC, BC are 3cm and 5cm respectively and the arc AB is a quarter of a circle. Calculate the radius of the arc AB correct to $\frac{1}{10}$ cm. (3 marks)
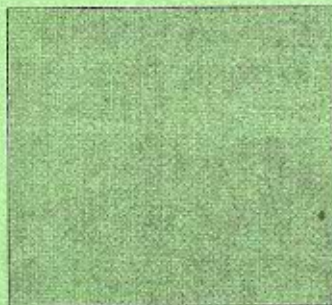
12. If $\begin{bmatrix} \frac{1}{10} & \frac{-3}{10} \\ \frac{1}{5} & \frac{2}{5} \end{bmatrix}$ is the inverse of matrix B. Find matrix B. (3 marks)

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13. Find the inequalities that are satisfied by the unshaded region R in the figure below. (4 marks)
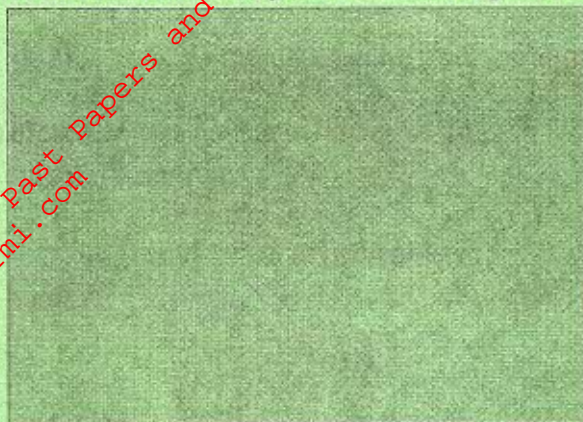
14. A line AB is divided into two parts AC and CB such that AC:CB =3:5. A further point D divides CB into two parts such that CD : DB = n : 1. If AD : DB = 19 : 5, find n. (3 marks)

15. A steel rivet shown below is in the shape of a cylinder surmounted by a hemisphere. The diameter of the cylinder is 0.5cm and that of the head is 1cm, the height of the rivet is 2cm. Find the weight of 200 rivets if steel weighs 0.285kg/cm³. (Take π to be 3.142) (3 marks)

16. The velocity, Vms⁻¹ of a body at time t seconds is given by $v = 2t + 3t^2$. Estimate by trapezium rule, the total distance travelled by the body from t = 0 to t = 10 seconds using six ordinates. (3 marks)

SECTION II (50MARKS)

Attempt ANY FIVE questions in this section:

17. a) A particle moves in a straight line with a constant velocity of 5ms⁻¹ for 2 seconds. It then moves with a constant acceleration of -2ms⁻² for 8 seconds. Draw a velocity - time graph for the interval of 10seconds in the graph paper provided hence find:
   i) the final velocity
   ii) the total distance covered by the particle. (6 marks)

   b) A racing cyclist completes the uphill section of a mountain course of 75km at an average speed of s km/hr. He then results downhill along the same route at an average speed of (s +20)km/hr. Given that the difference between the time is 1hour, find the total time taken to complete the uphill and the downhill sections of the course. (4 marks)

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18. a) i) Find the equation of the tangent to the curve $x^2 = y$ where the x-co-ordinate is m. (3marks)

    ii) Find the values of m in (i) above for which this line passes through (2,0) (2 marks)

    iii) Deduce the equations of the tangents from the point (2,0) to the curve $x^2 = y$. (2 marks)

  b) Express y as a function of x if $\dfrac{dy}{dx} = (x + 1)(x - 2)$ and the (x, y) graph passes through (1,5). (3 marks)

19. a) Using a scale of 2cm for one unit on x axis and 1cm for 2 units on y axis, draw the graph of $y = -2x - x^2 + x^3$ for values of x between -3 and +3. (5 marks)

  b) Using your graph estimate the solutions of the following equations.
    i) $2x^3 - 2x^2 - 4x + 3 = 0$ (2 marks)
    ii) $x^3 - x^2 - 3x + 1 = 0$ (2 marks)
    iii) $2x^3 - 2x^2 - 4x = 0$ (1 mark)

20. Two railway stations P and Q are such that Q is 500km due East of P. Two trains M and N leave from P and Q respectively at the same time. Train M moves at 360km/hr on a bearing of N30⁰E. Train N moves at 240km/hr on a bearing N45⁰W. The two trains stop after $1\frac{1}{2}$hrs.

Using a scale of $\dfrac{1}{10^7}$.
  a) Show the relative positions of the trains after $1\frac{1}{2}$ hrs (6 marks)
  b) Find the distance between the trains after $1\frac{1}{2}$ hrs (2 marks)
  c) Find the true bearings
    i) the bearing of M from N
    ii) the bearing of N from M after $1\frac{1}{2}$hrs (2 marks)

21. a) Using a scale of 1cm to 1unit on both axis, draw the flag F formed by the points (2,1) (2,2), (2,3) and (3, 2). (1 mark)

E is an enlargement with centre (0,2) and scale factor 2. T is a translation $\begin{pmatrix} -1 \\ -5 \end{pmatrix}$ which maps the point (x, y) onto the point $\{(x-1, (y-5)\}$ R is the anticlockwise rotation of 90⁰ about (3,-2).
  b) Show the image of the flag under
    i) E (F) (2 marks)
    ii) T(F) (2 marks)
    iii) RT (F) (2 marks)
  c) Describe the transformation RT (3 marks)

22. a) On the same axis plot the graph of $2y = \sin(2\theta + 30^0)$ and $y = \sin \theta$ for the domain $-2\pi^c \leq \theta \leq 2\pi^c$ by taking intervals of θ to be $\dfrac{\pi}{3}$. Take a scale of 1cm to represent $\dfrac{\pi}{3}$ on the x-axis and 1cm to represent 0.25 units on the y axis. (6 marks)

  b) Using your graph find the solution of the equation $0.5\sin(2\theta + 30^0) - \sin \theta = 0$. (1 mark)

  c) State the amplitude and period of the two curves. (2 marks)

  d) Determine the transformation that maps $2y = \sin(2\theta + 30^0)$ onto $y = \sin \theta$. (1 mark)

23. Points A, B and C lie on a circle centre O and radius 3.5cm. Angle AOC = 120⁰ and B lies on a minor arc AC. Arc AB is 4 times arc BC. Lines OB and AC meet at X.

   a) Draw an accurate sketch to represent this information.   (2 marks)

   b) Giving reasons find:
      i) ∠CAO   (2 marks)
      ii) ∠CXB   (2 marks)
      iii) ∠ABC   (2 marks)
      iv) ∠CAB   (2 marks)

24. a) In 1998, the total cost of manufacturing an article was Ksh. 5000 and this was divided between the costs of material, labour and transport in the ratio 8:14:3. In 2002, the cost of material was doubled, labour costs increased by 30% and transport increased by 20%. Calculate:

     i) the cost of manufacturing of the article in 2002   (3 marks)
     ii) In 2006, the cost of manufacturing of the article was Kshs. 7924 as a result of increase in labour costs only. Find the percentage increase in labour costs of 2006.   (3 marks)

   b) A bus owner has two buses for transporting people between towns A and B. One is a 26 - seater minibus and the other is a 64 - seater bus. Each of the buses makes 3 round trips per person. Calculate how much money the owner makes at the end of each day assuming both buses are always full.   (4 marks)