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

121/2
MATHEMATICS
PAPER 2
2 ½ HOURS
JULY 2016

JOINT EVALUATION TEST
Kenya Certificate of Secondary Education
Mathematics paper 1

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 15 printed pages. Candidates should check the question paper to ensure that all the pages are printed as 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

GRAND TOTAL

17	18	19	20	21	22	23	24	TOTAL

1. Solve for x given: (3 marks)

   $\log_{27}(x + 7) - \log_{27}(x - 1) = {}^2/_3$

2. The equation of a circle is given by $2x^2 + 6x + 2y^2 + 8y = 0$. Find the centre and radius of the circle.   (3 marks)

3. Solve for θ for values of $0^0 \le \theta \le 360^0$ (3 marks)
   $3 - 3\cos\theta = 2\sin^2\theta$

4. Find the equation of the tangent and the normal to the curve $y = x^2 - 3x + 5$ which is parallel to the line $y = 5x + 4$.　　(4 marks)

5. The triangle T has vertices at the points $(1,K)$, $(3,0)$ and $(11,0)$ where K is a constant. Triangle T is transformed onto the triangle T^1 by the matrix $\begin{pmatrix} 6 & -2 \\ 1 & 2 \end{pmatrix}$. Given that the area of triangle T^1 is 364 square units, find the value of K.　　(4 marks)

6. Expand $(3x^2 + 2x^{-2})^6$. State the independent term.　　(2 marks)

7. Find the co-ordinates of the point A (-4,2) after a rotation of 60^0 about the origin followed by a reflection in the line $y = -x$, leaving your answer in surd form. (3 marks)

8. A curve passes through the points (-1,0) and (2,0). Find the equation of the curve in the form $y = ax^2 + bx + c$, where a, b, c are constants. (2 marks)

9. A point P divides **AB** with co-ordinates A (2, -1, 4) and B (6, -3, 5) externally in the ratio 3 : 1. Find the co-ordinates of P and the magnitude of **OP**. (4 marks)

10. XY and RS are parallel chords on opposite sides of the centre of a circle of radius 13cm. If XY = 24 cm and RS = 20 cm, find the distance between the chords. Give your answer truncated to 4 s.f. (3 marks)

11. From a 35 metre high window, the angle of depression to the top of a nearby streetlight is 50^0. The angle of depression to the base of the streetlight is 56.5^0. How high is the streetlight correct to 3 d.p. (4 marks)

12. Simplify: (3 marks)

$$\frac{4}{\sqrt{5}+\sqrt{2}} - \frac{3}{\sqrt{5}-\sqrt{2}}$$

13. Two variables P and Q are such that P varies partly as the square root of Q and partly as Q. Determine the relationship between P and Q when Q = 16, P = 500 and when Q = 25, P = 800. (3 marks)

14. The 10th, 25th and the last term of an AP are 313, 193 and -7. Find the number of terms in the series. (3 marks)

15. The figure below shows a rectangle PQRS with PQ = 7 cm and QR = 5 cm. A variable point T inside the rectangle is such that angle PTQ $\geq 90^0$ and angle STR $\geq 90^0$. By shading the unwanted region locate the region in which T lies. (3 marks)
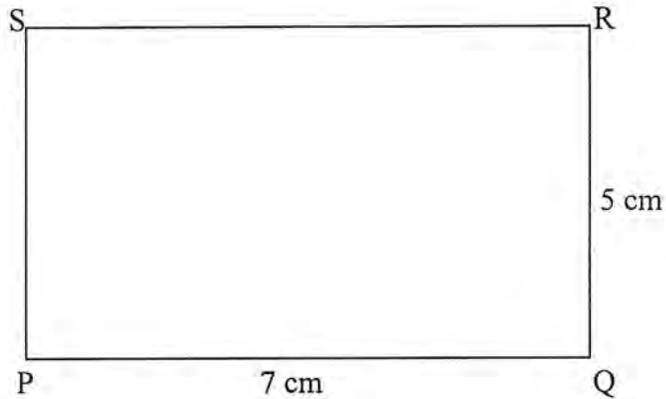
16. A lady bought a car on hire purchase terms. She paid a deposit of Sh 320,000. On the balance, compound interest was charged at 18% p.a. for 4 years. The interest charged and the balance were paid in 48 equal monthly installments of Sh 34,980. Calculate the price of the car to the nearest shilling. (3 marks)

17. The figure below shows a triangle OAB in which M divides OA in the ratio 2 : 5 and N divides OB in the ratio 5 : 3. AN and BM intersect at X.
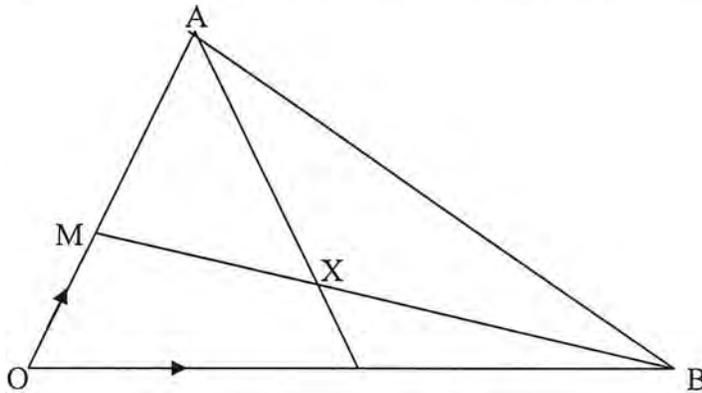
(a) Given that OA = **a** and **OB** = **b**, express in terms of **a** and **b**.

    (i)   **AN**   (1 mark)

    (ii)   **BM**   (1 mark)

(b) If AX = kAN and BX = hBM where k and h are constant, write two expressions for OX in terms of a, b, k and h. Find the values of k and h.   (8 marks)

18. The age distribution of workers in a factory is given in the following table.

Age yrs	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55
Frequency	2	10	12	23	10	8	2	3

(a) Using a suitable assumed mean, calculate the mean and the standard deviation. (4 marks)

(b) Draw an Ogive for the above distribution and use it to find the median, interquartile range and quartile deviation. (6 marks)

graph.

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19. Mueni earns a basic salary of Ksh 55,000. She is housed by the employer and is given taxable allowances amounting to Ksh 10,580. The table below shows income tax rates.

Monthly taxable pay K£	Rate of tax Ksh / £
1 – 435	2
436 – 970	3
971 – 1505	4
1506 – 2040	5
Excess over 2040	6

(a) If taxable income is gross salary plus $^{15}/_{100}$ of basic salary calculate her total monthly tax in Ksh per month. (5 marks)

(b) Mueni is entitled to personal relief of Ksh 1200 per month. Determine her net tax in Ksh per month. (2 marks)

(c) If she pays NHIF Sh 320, and contributes Sh 5,000 as shares to cooperative society. In addition she contributes Ksh 13,000 towards her loan repayment, calculate her net salary. (3 marks)

20. Four towns P, Q, R and S are located on the earth's surface at the following co-ordinates P $(0^0, 15^0W)$, Q $(0^0, 15^0E)$, R $(45^0N, 15^0E)$, S $(45^0N, 15^0W)$. At noon, two aircrafts A and B each flying at a speed of 350 km/h start simultaneously from P and S and flew towards Q and R respectively. Each aircraft files along the parallel of latitude.

   (a) Determine the distance from:
      (i)   P to Q   (2 marks)

      (ii)   S to R   (2 marks)

   (b) Calculate the time taken by:
      (i)   A from P to Q   (2 marks)

      (ii)   B from R to S.   (2 marks)

   (c) Determine at what time of the day each aircraft arrives at its destination.   (2 marks)

21. (a) Two variables x and y are connected by the law $y = \left(\dfrac{m}{x} + n\right)^{\frac{1}{2}}$ for all positive values of x.

  (i) Convert the equation above into linear form.

  (ii) State the variables to be plotted against each other to give a straight line graph.

  (1 mark)

  (b) The table below gives corresponding values of x and y. Complete the table by filling the blank boxes.

x	1.5	2	2.5	3	3.5	4
y	$\sqrt{13}$	$\sqrt{11}$	$\sqrt{9.8}$	3	$\sqrt{8.43}$	$\sqrt{8}$

  (c) By drawing a suitable linear graph, determine:
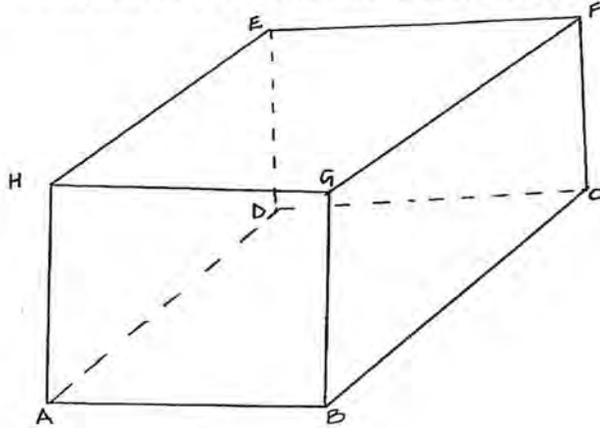 (i) the values of m and n.

  (5 marks)

graph.

  (ii) the law connecting y and x.

  (1 mark)

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22. The diagram below shows a cube of sides 20cm. calculate to one decimal place:

(a) The length of AF   (2 marks)

(b) The length of BF   (2 marks)

(c) The size of the angle between plane BFD and the base ABCD.   (2 marks)

(d) The shortest distance between point B and the plane ACF.   (2 marks)

(e) Find the angle θ made by the line HF and its skew line BC.   (2 marks)

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23. For a mathematics contest examination, at least 4 but not more that nine students are to be chosen to make a group. The ratio of the number of boys to the number of girls must be less than 2 : 1 and there must be more boys than girls. If x and y represent the number of boys and girls respectively:

(a) Write down in their simplest form all the inequalities in x and y. (4 marks)

(b) On the grid provided, graph the inequalities in (a) above, by shading the unwanted region and clearly indicate the region that satisfy the inequalities by letter R. (4 marks)

graph.

(c) By use of a search line, or otherwise find the composition of the contest group of:
    (i)   Largest size (1 mark)

    (ii)   Smallest size (1 mark)

24. Draw on the same set of axes, the graph of $y = \text{Sin } x$ and $y = 2\text{Sin } (x + 30^0)$ in the range $-240^0 \leq x \leq 240$. Using a scale of x axis 1 cm rep 30^0, y axis 1 cm rep 0.5 units.

graph.

(a) Find the period and the amplitude of the functions.

(b) What transformation maps the graph of $y = \text{Sin } x$ onto the graph of $y = 2 \text{ Sin } (x + 30^0)$.

(c) State the phase angle of $y = 2 \text{ Sin } (x + 30^0)$