121/1
MATHEMATICS
PAPER 1
JULY/AUGUST, 2016
TIME: 2½ HOURS
$\qquad$

## KIRINYAGA CENTRAL SUB-COUNTY EFFECTIVE FORTY JOINT EXAMINATION - 2016

## Kenya Certificate of Secondary Education <br> MATHEMATICS

PAPER 1
TIME: 2½ HOURS

## INSTRUCTION TO CANDIDATE'S:

1. Write your name, index number and school in the spaces provided at the top of this page.
2. Sign and write the date of examination in spaces provided above.
3. This paper consists of two Sections; Section I and Section II.
4. Answer all the questions in Section I and any FIVE questions from Section II.
5. All 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 answer at each stage in the spaces provided below each question.
7. Marks may be given for correct working even if the answer is wrong.
8. Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
9. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

## 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 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |  |

## SECTION I: (50 MARKS)

## Answer all the questions in the section.

1. Evaluate: $\frac{28-(-18)}{-2}-\frac{15-(-2)(-6)}{-3}$.
2. John spent $2 / 3$ of his salary on food $1 / 3$ of the remainder on rent and saved the rest. What fraction of his salary did he save? If he spent Sh. 1200 on food, how much did he spend on rent.
(3mks)
3. Given that $\sin \theta=\frac{1}{\sqrt{5}}$ where $\theta$ is an acute angle, find without using Mathematical tables or 'a calculator'.
(a) $\operatorname{Cos} \theta$ in the form $a \sqrt{b}$.
(b) $\operatorname{Tan}(90-\theta)$.

4．Use tables 1 and table 2 below to find the average speed that the Nairobi－Mombasa passenger train uses to travel between Konza and Masongaleni．
Table 1：Shows the rail distance in km between selected stations from Mombasa to Nairobi．
Table 2：Shows the departure and arrival time between selected stations from Mombasa to Nairobi．

Table 1 －is a travel table for a passenger train from Nairobi to Mombasa

| w．e．f．15／10／2001 | Passenger train |  |
| :--- | ---: | ---: |
| Station | $A R R$ | $D E P$ |
| Nairobi Yard |  | 1900 |
| Athi River | 1952 | 1954 |
| Konza | 2055 | 2057 |
| Sultan Hamad | 2234 | 2236 |
| Makindu | 2354 | 2356 |
| Kibwezi | 0025 | 0027 |
| Masongaleni | 0057 | 0059 |
| Mtito Andei | 0158 | 0213 |
| Voi | 0423 | 0438 |
| Mariakani | 0718 | 0720 |
| Mazeras | 0740 | 0742 |
| Mombasa | 0825 |  |

ARR－Arrival time at station
DEP－Departure time from station
Table 1

| $\begin{aligned} & \text { "̄ } \\ & \text { 음 } \\ & \text { Z } \end{aligned}$ | $\underset{\sim}{\ddot{\sim}}$ |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 29.6 | 若 | 0 | $\begin{aligned} & \text { 플 } \\ & \text { 荷 } \end{aligned}$ |  |  |  |  |  |  |  |
| 73.7 | 44.1 | \％ | $\begin{gathered} \text { II } \\ \text { 馬 } \end{gathered}$ |  |  |  |  |  |  |  |
| 130 | 100.4 | 56.3 | $\bar{\varpi}$ | ． |  |  |  |  |  |  |
| 193.4 | 163.8 | 119.7 | 63.4 | $\sum_{\sum}^{\pi}$ | N |  |  |  |  |  |
| 215.3 | 185.7 | 141.6 | 85.3 | 21.9 | 受 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | ＊ |  |  |  |
| 233.1 | 203.5 | 159.4 | 103.1 | 39.7 | 17.8 | $\sum^{\pi}$ | を |  |  |  |
| 266.6 | 237 | 192.9 | 136.6 | 73.2 | 51.3 | 33.5 | $\sum$ |  |  |  |
| 365.9 | 336.3 | 292.2 | 235.9 | 172.5 | 150.6 | 132.8 | 99.3 | $\stackrel{\text {－}}{ }$ | \％ |  |
| 492 | 462.4 | 418.3 | 362 | 298.6 | 276.7 | 258.9 | 225.4 | 126.7 | $\sum_{\mathrm{N}}^{\mathrm{N}}$ | \％ |
| 506.4 | 476.8 | 432.7 | 376.4 | 313 | 291.1 | 273.3 | 239.8 | 140.5 | 14.4 | 玉̃ |
| 530.3 | 500.7 | 456.6 | 400.3 | 336.9 | 315 | 297.2 | 263.7 | 164.4 | 38.3 | 23.9 |

Table 2
5. Solve the following simultaneous equations.

$$
\begin{aligned}
& \chi^{2}+y^{2}=26 \\
& \chi+y=4
\end{aligned}
$$

6. A Kenyan company received US Dollars 100,000. The money were converted into Kenya shillings in a bank which buys and sells foreign currencies as follows.

Buying (Ksh) Selling (Ksh)
$\begin{array}{lrr}1 \text { US Dollar } & 77.24 & 77.44 \\ 1 \text { Sterling Pound } & 121.93 & 122.27\end{array}$
(a) Calculate the amount of money, in Kenya shillings, the company received.
(b) The company exchanged the Kenya shillings calculated in (a) above, into sterling pounds to buy a car from Britain. Calculate the cost of the car to the nearest sterling pond.
7.


In the figure above O is the centre of the circle. Given that $\mathrm{PR}=\mathrm{QR}$ and $\angle \mathrm{PQR}=69^{\circ}$. Find $\angle \mathrm{RQO}$.
8. Find the smallest number which leaves a reminder of 4 when divided by either 8 or 12 or 14 .
9. Find the integral value of $\chi$ which satisfy the inequality.

$$
\begin{equation*}
3+2 \chi<3 \chi-1 \leq 2 \chi+7 \tag{3mks}
\end{equation*}
$$

10. A line $L$ is perpendicular to $2 \chi+y=3$ and passes through point (4, -1 ). Determine (i) the equation of line L .
(ii) the acute angle that line $L$ makes with the $\chi$-axis.
11. The angle of elevation of the top of a storey building from point P is $23.61^{\circ}$. From another point Q six metres nearer to the base of the building, the angle of depression from the top of the building is $35^{\circ}$. Calculate to 1 decimal place the height of the building.
(4mks)
12. State the amplitude and the period of the function $y=3 / 2 \operatorname{Cos}\left(2 \chi+30^{\circ}\right)$. (2mks)
13. In a fund raising committee of 45 people, the ratio of men to women is $7: 2$. Find the number of women required to join the existing committee so that the ratio of men to women is changed to 5: 4 .
14. The figure below is a semi-cylindrical solid of length 18 cm and radius 3.5 cm are shown.


Draw a labelled net of the sold.
15. Find the radius of the circle whose major segment is given below if $C M=A B=8 \mathrm{~cm}$.
16. Given that $P=3^{y}$ express the equation $3^{2 y-1}+2 x 3^{y-1}$ in terms of $P$. Hence or otherwise find the value of y in the equation $3^{2 y-1}+2 \mathrm{x} 3^{y-1}=1$ (3mks)

## SECTION II: (50 MARKS)

## Answer only ANY FIVE questions in this section.

17. Mutwapa Primary School is 30 km on a bearing of $015^{\circ}$ from a tourist hotel. The nearest town is 45 km from the school on a bearing of $120^{\circ}$.
(a) Using a scale of 1 cm to represent 15 km , make a scale drawing of the positions of the school the tourist hotel and the town.
(4mks)
(b) How far is the tourist hotel from the town?
(c) What is the bearing of
(i) the town from the tourist hotel?
(ii) the school from the town?
18. The diagram below (not drawn to scale) represents the cross-section of a solid prism to 8.0 cm .

(a) Calculate the volume of the prism.
(b) Given that the density of the prism is $5.75 \mathrm{~g} / \mathrm{cm}^{3}$, calculate it's mass in grams.
(2mks)
(c) A second prism is similar to the first one but is made of a different material. The volume of the second prism is $246.24 \mathrm{~cm}^{3}$.
(i) Calculate the area of the cross-section of the second prism.
(ii) Given that the ratio of the mass of the first prism to that of the second is 2 : 5 , find the density of the second prism.
19. The distance between two towns $A$ and $B$ is 760 km . A minibus left town $A$ at $8: 15 \mathrm{am}$ and traveled towards $B$ at an average speed of $90 \mathrm{~km} / \mathrm{h}$. A matatu left $B$ at $10: 35 \mathrm{am}$ and on the same day and travelled towards A at an average speed of $110 \mathrm{~km} / \mathrm{h}$.
(a) (i) How far from A did they meet?
(ii) At what time did they meet?
(b) A motorist starts from his home at 10:30am on the same day and travelled at an average speed of $100 \mathrm{~km} / \mathrm{h}$. He arrived at B at the same time as the minibus. Calculate the distance from B to his home.
20. A jet flies from town $\mathrm{Q}\left(60^{\circ} \mathrm{S}, 24^{\circ} \mathrm{E}\right)$ to town $\mathrm{R}\left(60^{\circ} \mathrm{S}, 10^{\circ} \mathrm{W}\right)$ and then due north for 1200 nautical miles to town S.
(a) Obtain the latitude of S.
(b) Calculate the distance between Q and R in (i) Nautical miles.
(3mks)
(ii) km
(2mks)
(c) Find the total flight time if the jet flies at an average speed of 800 knots. (2mks)
21. The figure below shows a triangle inscribed in a circle. $A B=6 \mathrm{~cm}, B C=9 \mathrm{~cm}$ and $A C=10 \mathrm{~cm}$.


Calculate
(a) the interior angles of $\triangle \mathrm{ABC}$.
(b) the radius of the circle.
(c) the area of the shaded part.
22. A triangle has vertices $A(1,2), B(4,4)$ and $C(6,2)$.
(a) Draw triangle ABC on the grid provided.

(b) Construct the image triangle $\mathrm{A}^{1} \mathrm{~B}^{1} \mathrm{C}^{1}$ image of triangle ABC under a rotation of $90^{\circ}$ clockwise about the origin.
(c) Draw triangle $\mathrm{A}^{11} \mathrm{~B}^{11} \mathrm{C}^{11}$ the image of triangle $\mathrm{A}^{1} \mathrm{~B}^{1} \mathrm{C}^{1}$ under a reflection in line $\mathrm{y}=\chi$, state the coordinates of $\mathrm{A}^{11} \mathrm{~B}^{11} \mathrm{C}^{11}$
(d) Draw triangle $\mathrm{A}^{111} \mathrm{~B}^{111} \mathrm{C}^{111}$ the image of triangle $\mathrm{A}^{11} \mathrm{~B}^{11} \mathrm{C}^{11}$ under a reflection in the line $\mathrm{y}=0$ and state the coordinates of its vertices.
(e) Describe a single transformation that maps triangle $\mathrm{A}^{11} \mathrm{~B}^{11} \mathrm{C}^{11}$ onto triangle ABC.
23. In triangle $\mathrm{OAB}, \mathrm{OA}=\mathrm{a}$ and $\mathrm{OB}=\mathrm{b}$. Points P and T divide OB and AB in the ratio 2:3 and $1: 3$ respectively. Lines OT and AP intersect at Q.
(a) Draw the diagram to represent the above information.
(b) Express OP and AP in term of a and b .
(c) Express $\mathrm{OT} \underset{\sim}{\text { in }}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.
(d) Given further that $\mathrm{OQ}=\mathrm{\sim}=\mathrm{OT}$ and $\mathrm{AQ}=$ sAP, express $\mathrm{OQ}_{\sim}$ in two ways and hence find the values of $s$ and $t$.
24. The velocity of a particle, $\mathrm{Vm} / \mathrm{s}$, moving in a straight line after t seconds is given by

$$
V=3 t^{2}-3 t-6
$$

Find:-
(i) The acceleration of the particle after 2 seconds.
(ii) The distance covered by the particle between $\mathrm{t}=1$ and $\mathrm{t}=4$ seconds. (3mks)
(iii) The time when the particle is momentarily at rest.
(iv) The minimum velocity attained by the particle.
(3mks)

