**NAME:** ……

**INDEX NO:** ……

**CANDIDATES SIGNATURE**……

**DATE:**……

121/2
MATHEMATICS ALT A.
PAPER 2
JULY /AUGUST 2014
2 ½ HOURS

# Nakuru District Kenya Certificate of Secondary Education Trial Examination 2014

MATHEMATICS ALT. A.
PAPER 2
2½ HOURS

**INSTRUCTIONS TO CANDIDATES**

a) *Write your name and index number in the spaces provided above.*
b) *Sign and write the date of examination in the spaces provided*
c) *This paper consists of two sections:* ***Section I and Section II.***
d) *Answer all the questions in Section I and only five from section II.*
e) *Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.*
f) *Marks may be given for correct working even if the answer is wrong.*
g) *Non- programmable silent electronic calculators* ***and KNEC*** *Mathematical tables may be used except where stated otherwise.*
h) *Candidates should check the question paper to ascertain that all the pages are printed as*
i) *Candidates should answer the questions in English .*

**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**

## SECTION 1 (50 MARKS)
## ANSWER ALL THE QUESTIONS IN THIS SECTION

1. Use logarithms to evaluate $\dfrac{(0.06824)^3}{\sqrt[4]{0.05235}}$ (4 marks)

2. A bath tub has two inlet pipes $P_1$ and $P_2$ and an outlet pipe $P_3$. Pipe $P_1$ can fill an empty bath tub in 15 minutes while pipes $P_1$ and $P_2$ , when opened at the same time can fill the same empty bath tub in 6 minutes. $P_3$ can empty the tub in 12 minutes. Find the fraction of the tub filled if $P_2$ and $P_3$ are opened for 25 minutes. (3 marks)

3. To obtain the estimate value of 1056 ÷ 22, the numbers were first rounded off to the nearest ten. Calculate the percentage error arising from this rounding – off. (3 marks)

4. Make **R** the subject of the formular (3 marks)

$$P = \frac{CR}{\sqrt{K - CR^2}}$$

5. Without using mathematical tables or a calculator simplify

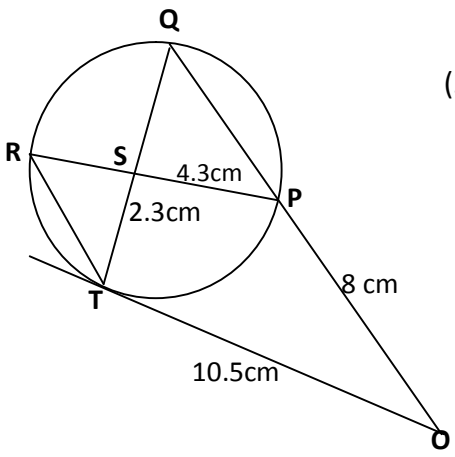
$$^2/_3 \log_3 27 - \log_3 5 + \log_3 45$$ (3 marks)

6 (a) Expand and simplify $\left(1 + \frac{1}{4}x\right)^6$ ( 2 marks)

(b) Use t he expansion in (a) above up to the fourth term to estimate the value of $(1.025)^6$ (2 marks)

7. In the diagram below ( not drawn to scale,) **PR** and **QT** are chords of a circle intersecting at **S. OT** is a tangent to the circle at **T**. Chord **QP** produced meets the tangent at **O.**

**(a)** Given that **O T** = 10.5 cm and **O P** = 8 cm.
Calculate the length of **P Q** (2 marks)



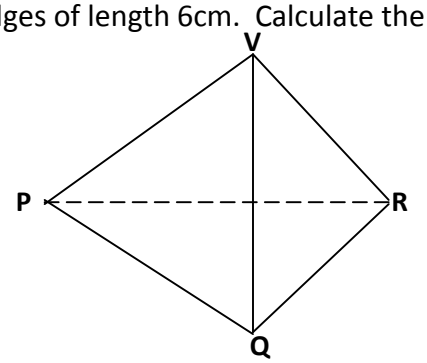

(b)Hence determine, to 1 decimal place the length of **TR** if **PS** = 4.3 and **TS** = 2.3 cm. (2 marks)

8. A mixture **P** contains sorghum and millet in the ration 2: 3. Another mixture **Q** contains sorghum and millet in the ration 3:1. 15kg of P is mixed with 24kg of **Q**, determine the ratio of sorghum and millet in the new mixture. (3 marks)

9. Rationalize the denominator leaving your answer in the form **a + b** $\sqrt{c}$ where **a, b** and **c** are constants (2 marks)

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

10. The figure below is a regular tetrahedron **VPQR** with edges of length 6cm. Calculate the angle between the planes **VQR** and **PQR** (3 marks)



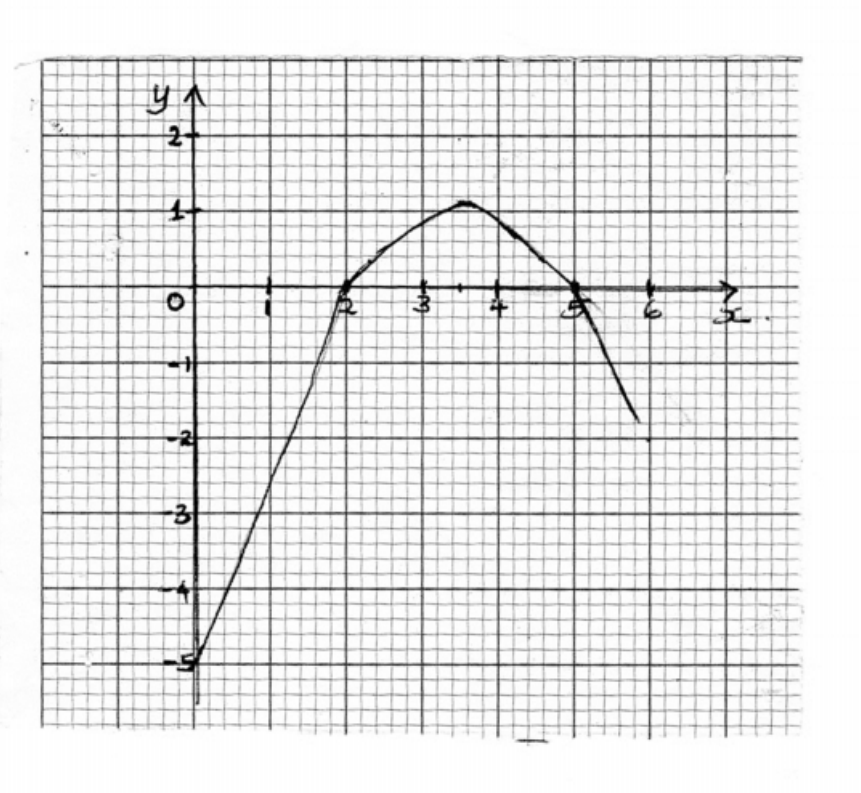

11. Solve for **x**: $\tan^2 x - 2\tan \mathbf{x} = 3$ for the interval (3 marks)
$0 \leq \mathbf{x} \leq 180^o$

12. A quantity **P** varies partly as the square root of **Q** and partly as the inverse of **Q**. Given that **P** = 14.5 when **q** = 4 and **P** = 17 when **Q** = 9 determine the equation connecting **P** and **Q.** **(4 marks)**

13. A car travelling at 94 km/hr is 5 m behind a truck travelling at 80 km/hr. If the truck is 13 m long and the car is 3 m long, deter mine the time taken in seconds for the car to completely overtake the truck. ( 3 marks)

14. The figure below shows a sketch of a graph of a quadratic function

Y = 3 c (x – 2) (x – 5)




Find the value of C (2 marks)

15. Given that $\begin{pmatrix} x & 2 \\ 4 & 2x \end{pmatrix}$ is a singular matrix

Determine the value of **x**, hence state the two possible matrices. (3 marks)



16. The equation of a circle is given by $5x^2 + 20x + 5y^2 - 25 = 0$. Find the radius and the centre of the circle (3 marks)

**SECTION II (50 MARKS)** ***ANSWER ANY FIVE QUESTIONS ONLY FROM THIS SECTION.***

17 The table below shows the income tax rates in 2012

| Income (K £ per annum) | Tax rate (Kshs. Per K £) |
|---|---|
| 1-5808 | 2 |
| 5809-11280 | 3 |
| 11281 – 16752 | 4 |
| 16753 - 22224 | 5 |
| 22225 - 27696 | 6 |
| Over 27896 | 6.5 |

In June 2012 Mrs Sudi earned the following per month: a basic salary of Kshs.23530, a house allowance of Kshs.8000, a medical allowance of Kshs.2844 and a commuter allowance of Kshs.2031.

She was entitled to a personal relief of Kshs.1056 per month.

(a) Calculate:

(i) Her taxable income in K£ per annum (1 mark)

(ii) The net tax paid by Mrs. Sudi in Kshs per annum (5 marks)

(b) In July 2012, Mrs. Sudi's Basic salary was increased in the ration 11:10 and received a hardship allowance that is 30% of her basic salary. Find the additional net tax per annum as a percentage (significant figures,) of the net tax obtained in (a)(ii) above ( to 4) (sig.fig) (4 marks)

18. In a mathematics test, the probability of 3 students, Kamau, Otieno and Mwala passing are ⅔, ¾ and ⅚ 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)

19. The position of two towns A and B are given to the nearest degree as **A** ($40^{o}$N, $110^{o}$E) and **B** ($50^{o}$N, $70^{o}$W).

(a) Find the shortest distance between the two towns in kilometers. (Take the radius of the earth as 6370 km). (3 marks)

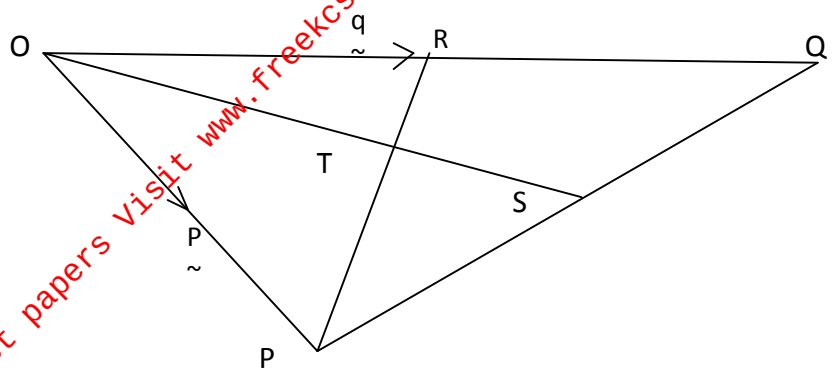
(b) An aircraft flew through the shortest route from town **A** to town **B** and then proceeded to town **C,** 6000 nm due south of **B** at an average speed of 850 km/h.

(i) Find the position of **C**

(ii) Find the time taken by the aircraft to fly from town **A** to town **C**. ( 2 marks)

(iii) Determine the local time at A when the local time at **C** is 5.30 p.m. (2 marks)

20. In triangle **OPQ** below, **R** and **S** are points on **OQ** and **PQ** respectively, such that the ratio **PS: SQ**= 2:1 and **OR** = ½ OQ. **T** is a point on **OS** such that **OT: TS**= 3:2.




Given that $\underset{\sim}{OP} = \underset{\sim}{p}$ and $\underset{\sim}{OQ} = \underset{\sim}{q}$

(a) Express the following vectors in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$

(i) $\underset{\sim}{PQ}$ (1 mark)

(ii) $\underset{\sim}{OS}$ (1 mark)

(iii) $\underset{\sim}{PR}$ (1 mark)

(iv) $\underset{\sim}{PT}$ (1 mark)

(b) Show that **P, T** and **R** are collinear (4 marks)

(c) Determine the ratio **PT:TR** (1 mark)

21 (a) Using a pair of compasses and a ruler only. Construct triangle **ABC** such that **AB**=7cm **BC**= 6cm and angle **ABC** = $60^{o}$. Measure **AC** (3marks)

b) On the same side of **AB** as **C**.

(i) Determine the locus of points P such that angle **APB** =$60^{o}$ (2 marks)

(ii) Construct the locus of **R** such that **AR**= 4.5cm (1 mark)

(iii) By shading the unwanted region identify the region **T** such that **AR** ≥ 4.5. Angle **APB** ≥ $60^{o}$ and angle **ACB** ≤ angle **BCA** . (4 marks)

22. Laptech company is considering installing two types of machines, Type **A** and type **B**, for assembly of spare parts of laptops. Type **A** machine can assemble 5 spare parts per hour while type **B** machine can assemble 3 spare parts per hour. Type **A** machine requires 11 operators while type **B** machine requires 9 operators. The number of type **B** machines must be more than the number of type **A** machines. The total number of spare parts assembled per hour must be at least 30 and the number of operators should not exceed 100. There should be at least 3 type **A** machines and at least 4 type **B** machines

.

(a) Taking **x** to be the number of type **A** machines and **y** to be the number of type **B** machines. Write down in terms of **x** and **y** the linear inequalities representing the information above (4 marks)



(b) On the grid provided draw the inequalities and shade the unwanted regions. (4 marks)

(c) If the company makes a profit of shs.6 per hour on type A machines and shs.2 per hour on type **B** machines, Use the graph in (b) above to determine the number of machines of each type that should be installed to maximize the profit. (2 marks)

23 A Manson lays bricks in the erecting of a perimeter wall. In consecutive days, he increased the number of bricks laid by an equal number. On the third day he laid 23 bricks, while on the seventh day he laid 35 bricks.

(a) **Calculate**

(i) The number of bricks he laid on the first day (2 marks)

(ii) The constant increase of the number of bricks laid daily (2 marks)

(iii) The number of bricks laid on the eleventh day (2 marks)

(b) If he laid 80 bricks on the last day, find the total number of bricks laid (4 marks)

24. The relationship between the pressure **P** of a fixed mass of a gas and its volume **V** at a constant temperature, is known to be of the form $P=\frac{K}{V}$ where K is a constant. The table below shows the experimental results for pressure and corresponding values of volume.

| | | | | | |
|---|---|---|---|---|---|
| Pressure ($N/cm^2$) | 1.1 | 1.8 | 2.2 | 2.6 | 3.4 |
| Volume (Litres) | 3.03 | 2.12 | 1.65 | 1.4 | 1.07 |

(a) Using the grid provided, plot the graph of **P** against $1/V$ ( 5 marks)

(b) From the graph estimate the value of **K** (3 marks)

(c) Determine the volume of the gas when the pressure is 3.1 $N/cm^2$ (2 marks)