

NAME.....

INDEXNO.....

SCHOOL.....

SGN.....

DATE.....

121/2

MATHEMATICS (Alt.A)

FORM 4

PAPER 2

MARCH/APRIL 2013

TIME: 2 1/2 HOURS

PENTAGON JOINT EXAMINATIONS - 2013 WARENG DISTRICT

The Kenya Certificate of Secondary Education

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.
3. The paper contains two sections: Section I and II.
4. Answer all questions in section I and **strictly 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 calculations, giving your answers at each stage in the spaces 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.

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

This paper consists of 15 printed pages. Candidates should check carefully to ascertain that all the pages are printed as indicated and no questions are missing.

SECTION I (50 MARKS): Attempt all the questions in this section.

1. Use logarithms to evaluate the value of $\frac{(0.4027)^{\frac{1}{3}}}{(0.098 + 5.6)^{-2}}$, Give your answer correct to **4 significant** figures. (3marks)

2. Pipes S and T can fill a tank in 2 hours and 3 hours respectively. Pipe U can empty the full tank in 4 hours. How long will it take to fill the tank with all the pipes running? (2marks)

3. Make d the subject in the given formula. $U = \frac{Vd^2}{2w + d^2}$ (3marks)

4. Find the area of triangle PQR such that the area of its image is 12cm^2 after a transformation given

by the matrix $\begin{pmatrix} 2 & 1 \\ 4 & 4 \end{pmatrix}$

(3marks)

5. The co-ordinates of points A and B are (1, -2) and (-2, 4) respectively. A point P divides AB externally in the ratio 4 : 1. Find the position vector of P.

(3marks)

6. Solve the equation $3 \sin x = 2 \cos^2 x$ where $0^\circ \leq x \leq 360^\circ$

(4marks)

7. Use binomial expansion to expand and simplify $(1-3x)^6$ up to term in x^3 . Hence approximate the value of $(0.97)^6$ correct to 4 significant figures. (4marks)

8. Given the points $P(-6, -3)$, $Q(-2, -1)$ and $R(6, 3)$, express PQ and QR as column vectors. Hence show that the points P , Q and R are collinear. (3marks)

9. The distance between two places $P(^\circ S, 35^\circ E)$ and $Q(^\circ S, 145^\circ W)$ on the earth via South Pole is 3240nm. Find
a) the value of $^\circ$. (2marks)

b) the distance between P and Q along the parallel of latitude in nautical miles. (2marks)

10. The expression $1 + \frac{x}{2}$ is taken as an approximation for $\sqrt{1+x}$. Find the percentage error in doing so if $x = 0.44$. (3marks)

11. Point T is the midpoint of a straight line AB. Given the position vectors of A and T are $i - j + k$ and $2i + 1\frac{1}{2}k$ respectively, find the position vector of B in terms of i, j and k (3marks)

12. The dimensions of a rectangle are 40 cm and 45 cm. If there is an error of 5 % in the length and 8% in the width, find the percentage error in calculating the area of the rectangle. (4marks)

13. A student's results in six mathematics' test were 24, 28, $32 + x$, 48 and 50 in that order. If the median is 36, find the mean mark. (3marks)

14. When the numerator of x/y is increased in the ratio 3:1 and the denominator decreased in the ratio 2:3, the resulting fraction is $27/28$. Find $x:y$ in its simplest form. (3marks)

15. A point $(-5,4)$ is mapped onto $(-1,-1)$ by a translation. Find the image of $(-4,5)$ under the same translation. (2marks)

16. Given that $\log 2 = 0.3010$ and $\log 3 = 0.4771$, evaluate $\log 15$

(3marks)

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SECTION II (50 MARKS): Attempt only FIVE questions from this section

17. Water flows through a cylindrical pipe of diameter 8.4cm at a speed of 50m/ minutes

a) Calculate the volume of water delivered by the pipe per minute in litres. (3marks)

b) A cylindrical storage tank of radius 105cm is filled by water from this pipe and at the same rate of flow. Water begins flowing into the empty storage tank at 9.30a.m and is full at 2.00pm. Calculate the height of this tank in metres square. (4marks)

c) A family consumes the capacity of this tank in one month. The cost of water is sh 50 per thousand litres and fixed basic charge of Ksh 1650. Calculate the cost of this family's water bill for a year. (3marks)

18. (a) Using a ruler and pair of compasses only, construct triangle **ABC** in which **AB**=9cm, **BC**=8.5cm and $\angle \mathbf{BAC} = 60^\circ$. (3marks)

(b) On the same side of **AB** as **C**:

- (i) Determine the locus of a point **P** such that $\angle \mathbf{APB} = 60^\circ$. (3marks)
- (ii) Construct the locus of **R** such that $\mathbf{AR} > 4\text{cm}$. (2marks)
- (iii) Determine the region **T** such that angle $\mathbf{ACT} \geq$ angle \mathbf{BCT} . (2marks)

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19. A laptop whose value when new is Kshs 50,000 depreciates at a constant rate of R% p.a such that after 5 years, its value becomes Ksh 20,000.

a) Determine the value of R.

(5marks)

b) How long does it take to the nearest year; for the laptop to depreciate by Ksh. 35,000?(5marks)

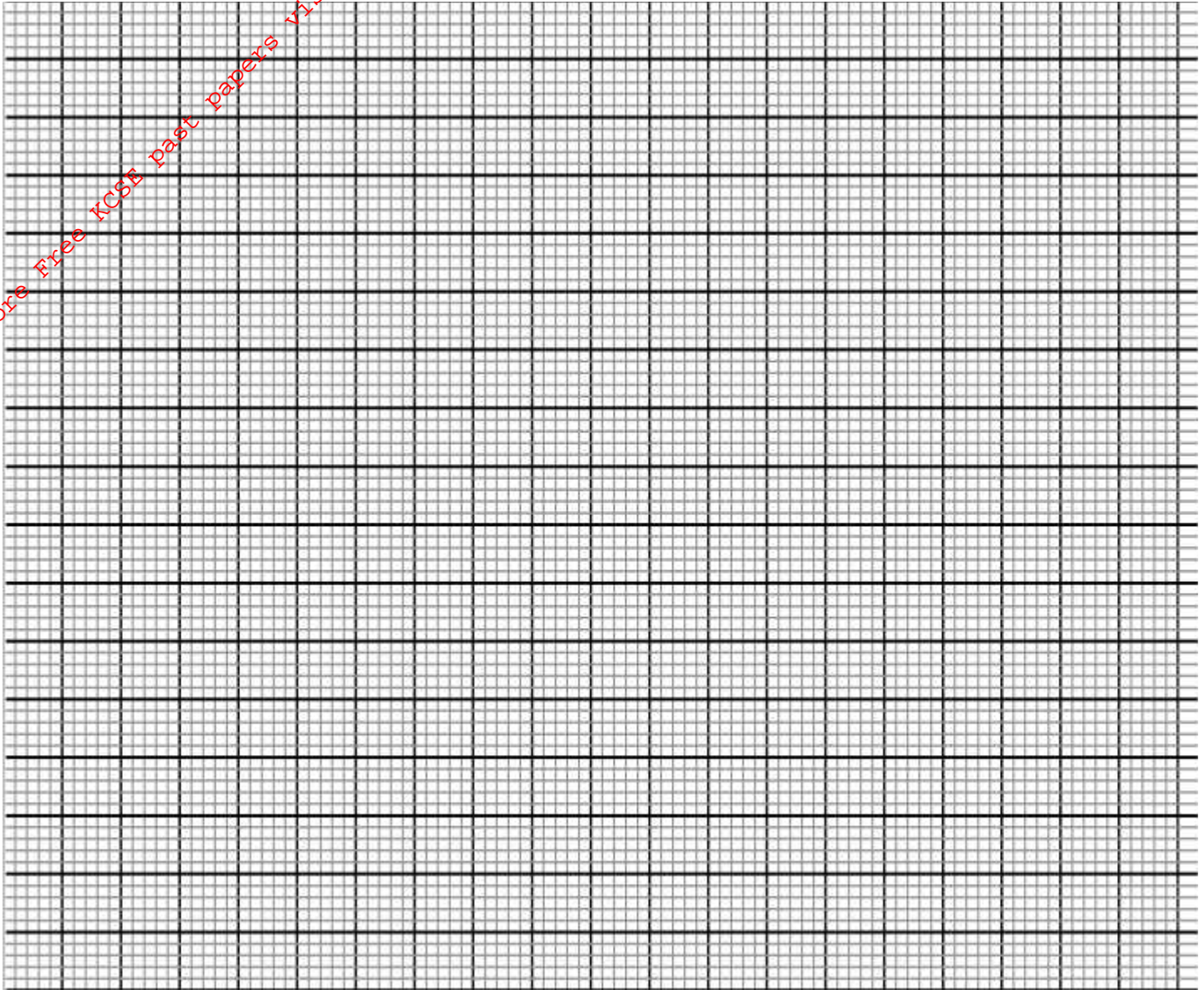
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20. Complete the table below by filling in the blank spaces

(3marks)

x°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$\cos x^\circ$	1.00		0.50			-0.87		-0.87					
$2 \cos \frac{1}{2} x^\circ$	2.00	1.93				0.52			-1.00				-2.00

Draw, on the grid provided, the graphs of $y = \cos x^\circ$ and $y = 2 \cos \frac{1}{2} x^\circ$ on the same axis. (5marks)



a) Find the period and the amplitude of $y = 2 \cos \frac{1}{2} x^\circ$ on the same axis. (1mark)

b) Describe the transformation that maps the graph of $y = \cos x^\circ$ on the graph of $y = 2 \cos \frac{1}{2} x^\circ$. (1mark)

21. An aeroplane flies from point A (1.25°S , 37°E) to a point B directly North of A. the arc AB subtends an angle of 45° at the center of the earth. From B, the aeroplane flies due west to a point C on longitude 23°W .

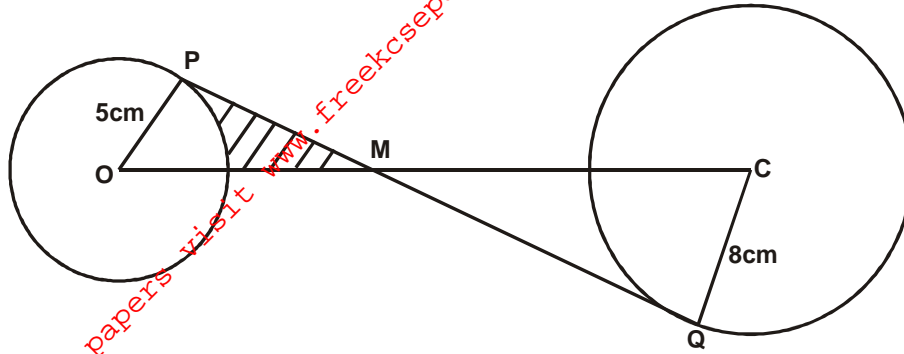
(Take the value of $f = \frac{22}{7}$ as and radius of the earth as 6370km)

(a) (i) Find the latitude of B (3marks)

(ii) Find the distance traveled by the aeroplane between B and C in km and in nm. (4marks)

(b) The aeroplane left B on Wednesday at 1.00 a.m local time. When the aeroplane was leaving B, what was the local time at C? (3marks)

22. The figure below (not drawn to scale) represents two circles centres O and C whose radii are 5cm and 8cm respectively. If the centres are 16cm apart and PQ is a transverse common tangent which intersects with line OC at point M.



Calculate;

- a) The length of the transverse (interior) common tangent. (5marks)

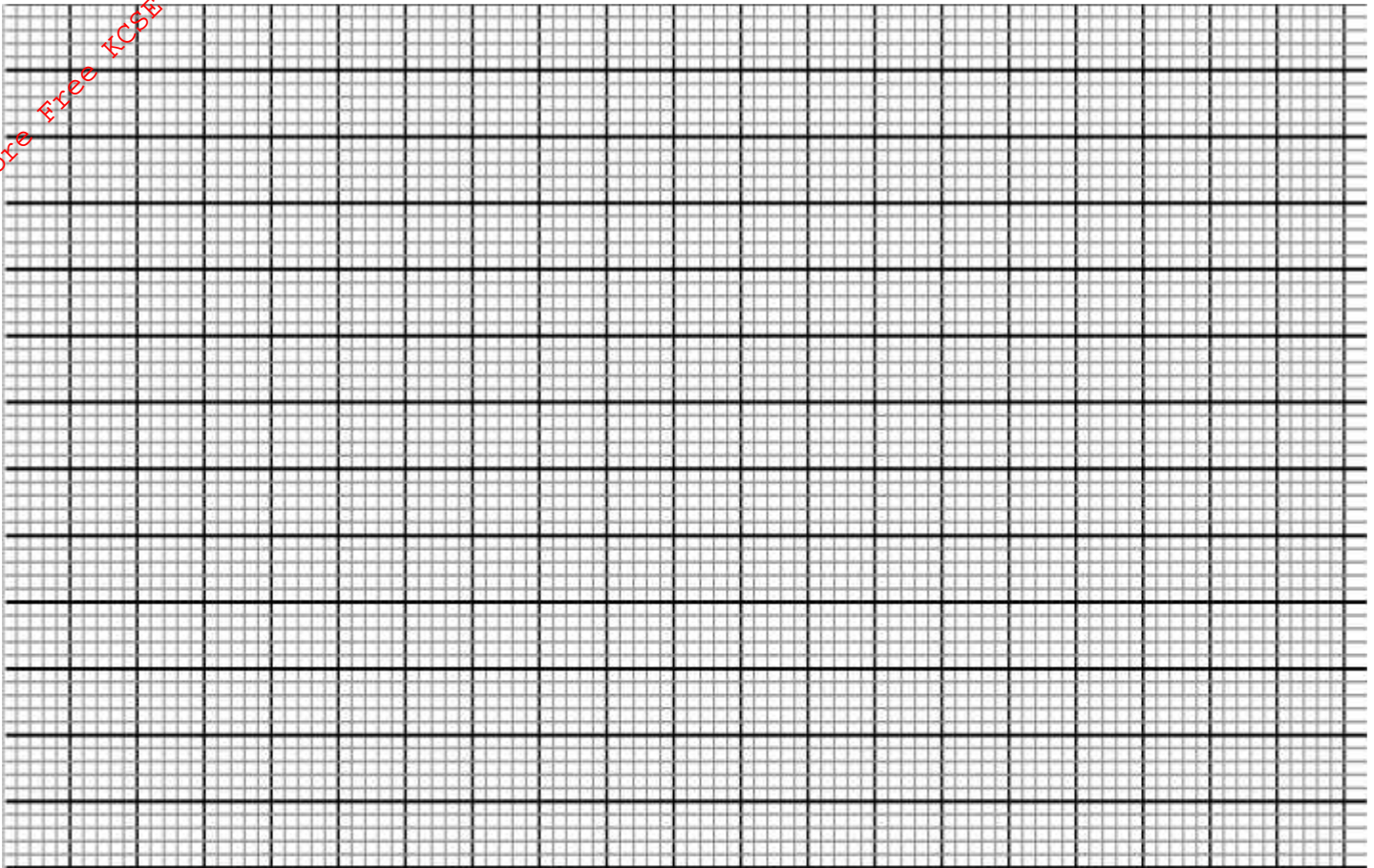
- b) The area of the shaded region. (Take $\pi = 3.142$) (5marks)

23. The table below shows the marks scored by students in a mathematics test.

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of students	3	5	6	21	12	6	4	2	1

(a) From the above table determine the 20th percentile. (2marks)

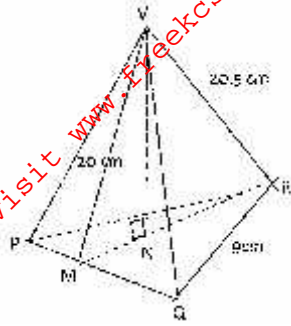
b) Use the above table to draw the cumulative frequency curve (ogive curve). (4marks)



(i) Using the above graph drawn in (b) determine the pass mark if 40% of the students passed (2marks)

(ii) If the pass mark was pegged at 65%, how many students passed. (2marks)

24. The figure below represents a model of a tower VPQR. The horizontal base PQR is an equilateral triangle of sides 9cm. The length of the edges are $VP = VQ = VR = 20.5\text{cm}$. Point M is the mid-point of PQ and $VM = 20\text{cm}$. Point N is on the base and vertically below V



Calculate

- (a) The length RM (2marks)

- (b) The height VN of the model. (4marks)

- (c) Projection of lines: VM and VN on the plane PQR (2mks)

- (d) Find the surface area of slant faces. (2mks)

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