NAME: ……..…….. INDEX NO: ……..…..

ADM NO……. SCHOOL: ……

CLASS……. CANDIDATE SIGN: ……

DATE: ……..……

121/2
MATHEMATICS
PAPER 2
TERM 2, 2024
TIME: 2 ½ HOURS

BOKAKE CLUSTER EXAMINATION 2024

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 above.
(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) All answers and working must be written on the question paper in the spaces provided below each question.
(f) ***Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.***
(g) Marks may be given for correct working even if the answer is wrong.
(h) ***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

SECTION I:5MARKS- ***Answer all questions from this section***

1. Rationalise the denominator and simplify leaving your answer in the form $\sqrt{a} + b$. **(3 marks)**

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

2. a) expand $(1 - \frac{1}{2}x)^5$ **(1 mark)**

b) Use the expansion upto x^3 in (a) above to evaluate $(0.98)^5$ correct to 4 d.p **(2 marks)**

3. Agotho has a rectangular plot that was measured to the nearest meter and found to be 80m in length and 60m in width. Determine the percentage error in its perimeter. (3 marks)

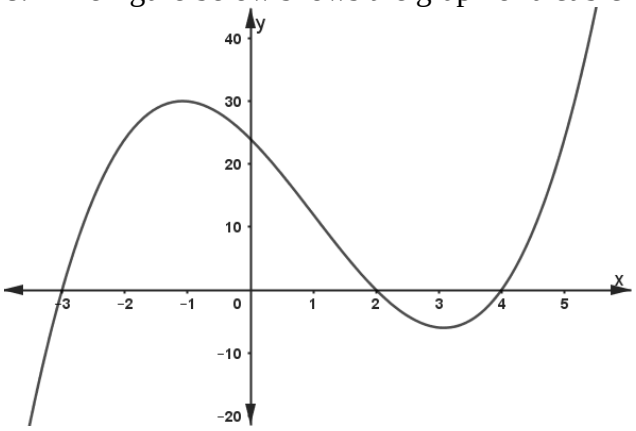
4. Simplify $\frac{9x^2-1}{3x^2+2x-1}$ (3 marks)

5. A circle of radius 3cm has its centre at (3, –2). Express the equation of the circle in the form $x^2 + y^2 + mx + ny + c = 0$. Where m, n and c are constants. (3 marks)

6. Find the value of x that satisfies the equation $\log(2x - 11) - \log 2 = \log 3 - \log x$ (4 marks)

7. Five men working 8 hours a day take 2 days to cultivate an acre of land. How many days would four men working 10 hours a day at double rate take to cultivate 3 acres of land? (3 marks)

8. The figure below shows the graph of a cubic function.

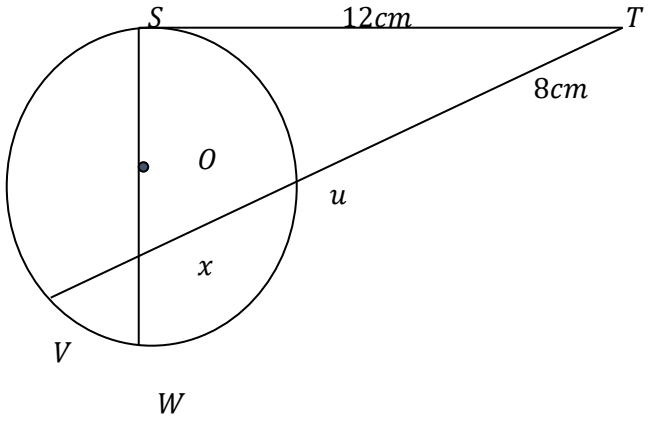


Write the equation of the function in the form $y = x^3 + ax^2 + bx + c$, where a, b and c are constants. (3 marks)

9. Given that $\mathbf{A} = \begin{pmatrix} 1 & k \\ 3 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -3 & 5 \\ 1 & -2 \end{pmatrix}$, find k if the determinant of **AB** is 9 (3 marks)

10. A variable P varies directly as t^3 and inversely as the square root of S. When $t = 2$ and $S = 9$ $P = 16$. Determine the equation connecting P, t and S hence find P when $S = 36$ and $t = 3$.
(3mks)

11. In the figure below the tangent ST meets chord Vu. Produced at T. chord SW passes through the centre O of the circle and intersect chord Vu at x. Line $ST = 12cm$ and $uT = 8cm$



a) Calculate the length of chord Vu. (1mk)

b) If $wx = 3cm$ and $Vx : xu = 2 : 3$. find Sx (2mks)

12. Make n the subject of the formula.

$$\frac{r}{P} = \frac{M}{\sqrt{n-1}}$$ (2mks)

13. The table below shows income tax rates in a certain year

Monthly income in Kshs	Tax rate in each kshs
$1 \leq x < 9681$	10%
$9681 \leq x < 18801$	15%
$18801 \leq x < 27921$	20%
$27921 \leq x < 37040$	25%
Over 37040	30%

In that year Mr. Mogaka gets a total deduction of ksh5,000 he gets a personal tax relief of kshs.1056 and pays kshs.3944 for NHIF, WCPS and sacco loan repayment. Calculate

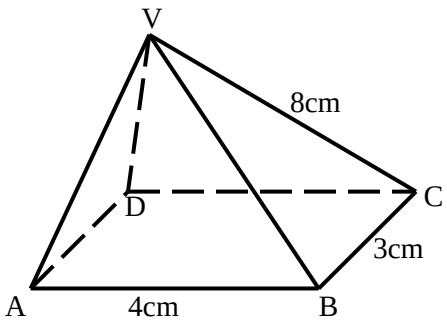
(i) P.A.Y.E. (1 mark)

(ii) Monthly income/salary (3 marks)

14. Use logarithms tables to evaluate. (4mks)

$$\sqrt[3]{\frac{36.72\times(0.46)^2}{185.4}}$$

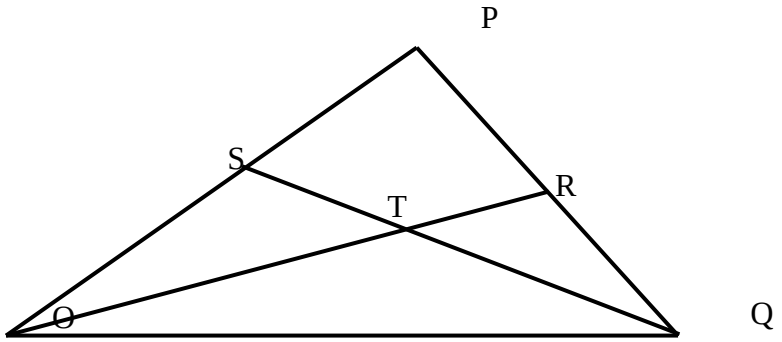
15. The figure below shows a rectangular based right pyramid. Find the angle between the planes ABCD and ABV. (2marks)



16. Find the shortest distance between points A(50^oS,25^ot) and B(50^oS, 140^oE in KM (Take R=6370 Km) (3mks)

SECTION II – 50 MARKS;Answer any FIVE questions from this section

17.



In the figure above, OPQ is a triangle in which $OS = \frac{3}{4}OP$ and PR: RQ = 2:1

Line OR and SQ meet at T.

h) Given that $OP = \underset{\sim}{p}$ and $OQ = \underset{\sim}{q}$, express the following vectors in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$.

(i) PQ **(1 Mark)**

(ii) OR **(2 Marks)**

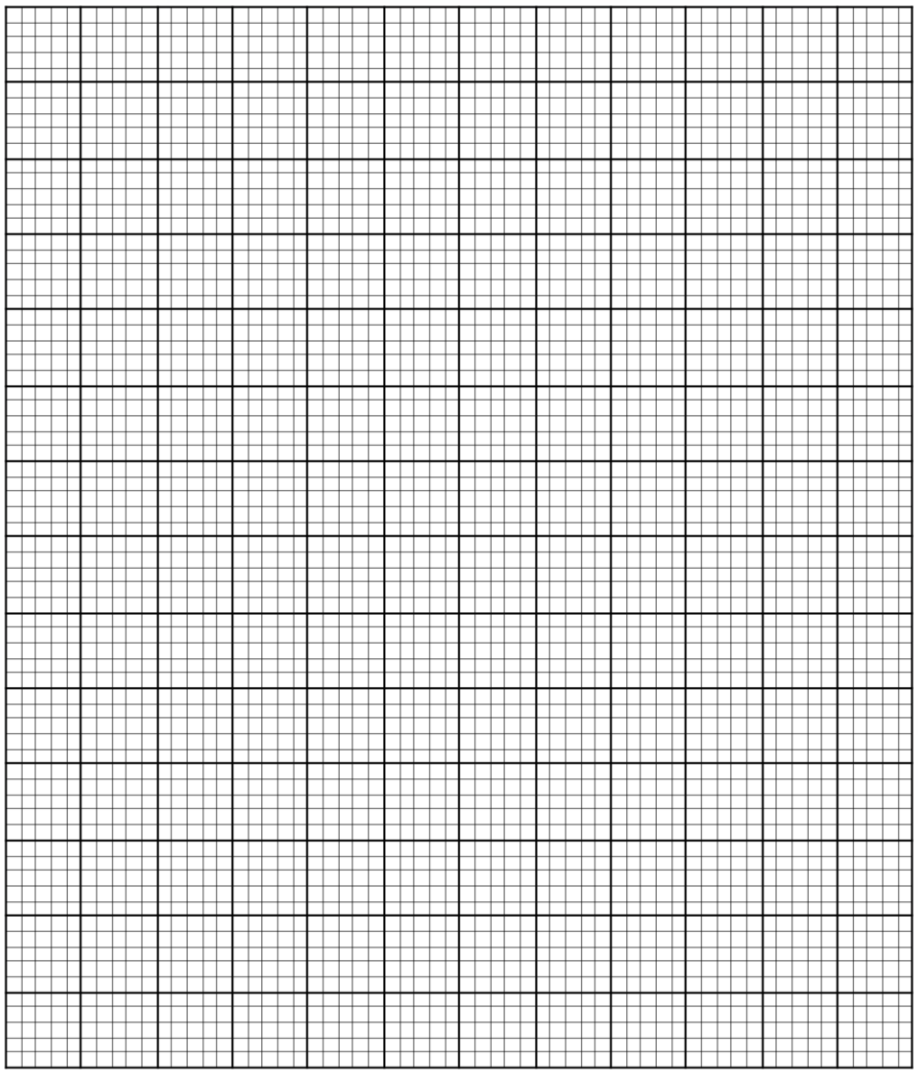
(iii) SQ **(1 Mark)**

i) You are further given that ST = mSQ and OT = nOR. Determine the values of m and n. (6 marks

18. (a) Complete the table given below for the functions $y = -3\cos 2x$ and $y = 2\sin\left(\frac{3}{2}x + 30\right)^0$ for $0^0 \leq x \leq 180^0$ (2 marks)

x^0	0	20	40	60	80	100	120	140	160	180
$-3\cos 2x$	-3.00			1.50	2.82	2.82		-0.52	-2.30	
$2\sin\left(\frac{3}{2}x + 30\right)^0$	1.00		2.00	1.73		0.00	-1.00			-1.73

(b) Using the grid provided, draw the graphs of $y = -3\cos 2x$ and $y = 2\sin\left(\frac{3}{2}x + 30\right)^0$ for $0^0 \leq x \leq 180^0$ on the same pair of axes. Take 1cm to represent 20^0 on the $x-$ axis and 2cm to represent 1 unit on the $y-$ axis. (5 marks)



(c) From the graphs in (b) above, find;

(i) the period of $y = 2\sin\left(\frac{3}{2}x + 30\right)^0$ (1 mark)

(ii) the values of x given that $2\sin\left(\frac{3}{2}x + 30\right)^0 + 3\cos 2x = 0$ (2 marks)

19. Awuor was paid an initial salary of Kshs. 180000 per annum with a fixed annual increment. Wasonga was paid and initial salary of Kshs. 150000 per annum with a 10% increment compounded annually.

(a) Given that Awuor's annual salary in the 11^{th} year was Kshs. 288,000, determine:

(i) Her annual increment. (2 marks)

(ii) The total amount of money Awuor earned during the 11 years. (2 marks)

(b) Determine Wasonga's monthly earning, correct to the nearest 10 shillings during the 11^{th} year (3 marks)

(c) Calculate the number of years it will take Awuor's total earnings to be Ksh. 1022400.(3 marks)

20. In a mixed school there are 420 boys and 350 girls. The probability that a girl passes her exams in the school is $\frac{4}{7}$ while that of a boy passing is $\frac{5}{8}$. The probability of a girl being made a prefect is $\frac{2}{11}$ while that of a boy is $\frac{1}{8}$.

Find the probability that a student picked at random.

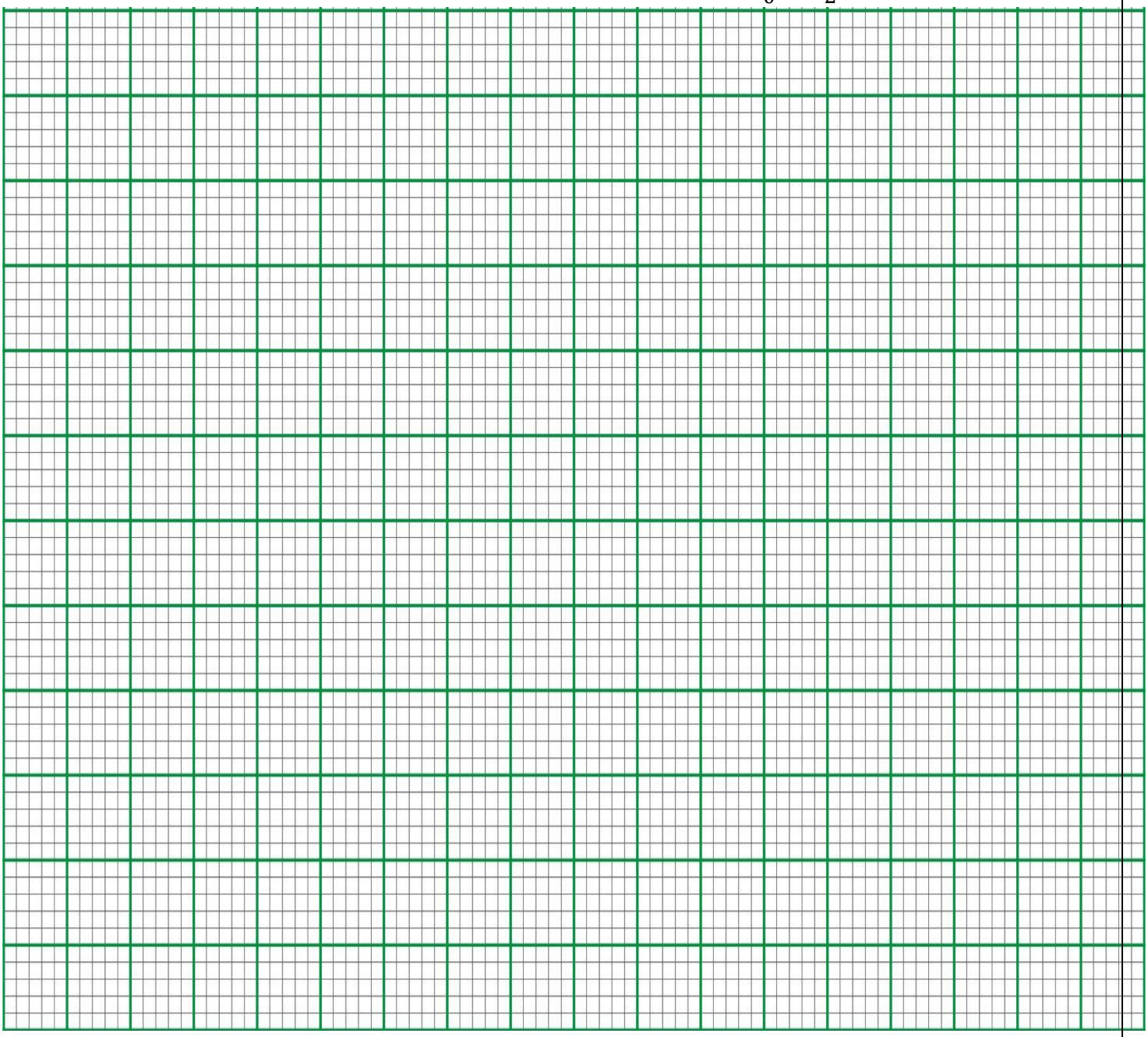
a) Is a boy and passes the exam and is not a perfect. (3mks)

b) Is a girl, a prefect and passes the exam. (3mks)

c) Is not as prefect and passes the exam. (4mks)

21. OABC is a parallelogram with vertices O (0, 0) A (2, 0) B (3, 2) and C (1, 2).

$O^1\ A^1\ B^1\ C^1$ is the image of OABC under transformation matrix $\begin{matrix} -2 & 0 \\ 0 & -2 \end{matrix}$



a) Find the co-ordinates of $O^1\ A^1\ B^1\ C^1$. (2mks)

b) On the grid provided draw OABC and $O^1\ A^1\ B^1\ C^1$ (2mks)

c) Find $O^{11}\ A^{11}\ B^{11}\ C^{11}$ the image of $O^1\ A^1\ B^1\ C^1$ under the transformation matrix $\begin{matrix} 1 & 0 \\ 0 & -2 \end{matrix}$ (2mks)

(i) On the same grid draw $O^{11}\ A^{11}\ B^{11}\ C^{11}$. (1mk)

(ii) Find the single matrix that map $O^{11}\ A^{11}\ B^{11}\ C^{11}$ onto OABC. (3mks)

22. A particle moves in such a way that the velocity V at any given time is
$v=10t - \frac{1}{2} t^2 - \frac{15}{2}$ mls.

(a) Calculate the initial velocity (1 mark)

(b) Calculate the velocity when the time t=3 (2 marks)

(c) Find the displacement during the 5^{th} second (4 marks)

(d) Calculate the maximum velocity attained (3 marks)

23. The 2^{nd} and 5^{th} terms of an arithmetic progression are 8 and 17 respectively. The 2^{nd}, 10^{th} and42^{nd} terms of the A.P. form the first three terms of a geometric progression. Find

(a) The 1^{st} term and the common difference. (3mks)

(b) The first three terms of the G.P and the 10^{th} term of the G.P. (4mks)

(c) The sum of the first 10 terms of the G.P. (3mks)

24. Matrix P is given by $\begin{pmatrix} 4 & 7 \\ 5 & 8 \end{pmatrix}$

(a) Find P^{-1} (2 Marks)

(b) Two institutions, Kamunyaka secondary School and Njabini mixed secondary School purchased beans at Sh. b per bag and maize at Sh. m per bag. Kamunyaka secondary purchased 8 bags of beans and 14 bags of maize for KSh. 47,600. Njabini mixed purchased 10 bags of beans and 16 bags of maize for KSh. 57,400.

(i) Form a matrix equation to represent the information above. (2 Marks)

(ii) Use matrix $P^{-1}$to find the prices of one bag of each item. (3 Marks)

(c) The price of beans later went up by 5% and that of maize remained constant. Kamunyaka secondary bought the same quality of beans but spent the same total of money as before on the two items. State the new ratio of beans to maize. (3 Marks)