

NAME.....ADM NO.....CLASS.....

121/1
 MATHEMATICS
 PAPER 2
 TIME: 2 ½ HOURS

**END OF TERM 1 2019 EXAMINATIONS
 MATHEMATICS PAPER 2
 FORM 4 EVALUATION EXAMINATION**

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and index number in the spaces provided.
- (b) This paper consists of two sections **I** and **II**
- (c) Answer all the questions in section **I** and **ONLY FIVE** questions in section **II**.
- (d) All answers and working must be written on the question paper in the spaces provided below each question.
- (e) Show all the steps in your calculation giving your answer at each stage in the space below each question.
- (f) Marks are given for correct working even if the answer is wrong.
- (g) Use calculators and KNEC mathematical tables except where stated otherwise.

FOR EXAMINER'S USE ONLY

SECTION

TOTAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

SECTION II

17	18	19	20	21	22	23	24	TOTAL

GRAND TOTAL

SECTION I: 50 MARKS

Answer all the questions in this section

1. If $x = -\frac{1}{2}$ and $x = \frac{2}{3}$ are the solutions of a quadratic equation, write the equation in the form $ax^2 + bx + c = 0$ where a, b and c are integers. (3 marks)

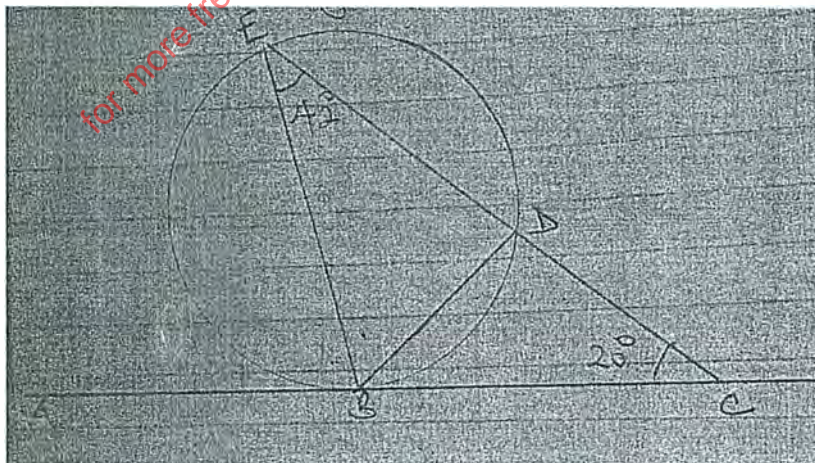
2. Find the percentage error in the product of 17.3 and 13.8. (3 marks)

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3. Musa bought three pens and four exercise books for a total of Ksh 155 while John bought two similar pens and five similar exercise books for a total of ksh 150. Determine using matrix method, the cost of a pen and that of an exercise book (4 marks)

4. Solve for x. $(\log_3 x)^2 - \frac{1}{2} \log_3 x = \frac{3}{2}$ (3 marks)

5. ABC is a tangent of the circle at B. Angle $BCD = 20^\circ$ and angle $BED = 42^\circ$. Calculate angle ABE and BDE. (3 marks)



6. Simplify the following surds, leaving your answer in the form $a + b\sqrt{c}$ where a, b , and c are constants (3 marks)

$$\frac{\cos 60^\circ}{\sin 45^\circ + \sin 30^\circ}$$

7. Make x the subject of the formula.

(3 marks)

$$p = 2\pi \sqrt{\frac{1+x^n}{w}}$$

8. Using a ruler and a pair of compasses only construct triangle ABC such that $AB = 6\text{cm}$, angle $CAB = 105^\circ$ and angle $ABC = 30^\circ$. Measure side BC (4 marks)

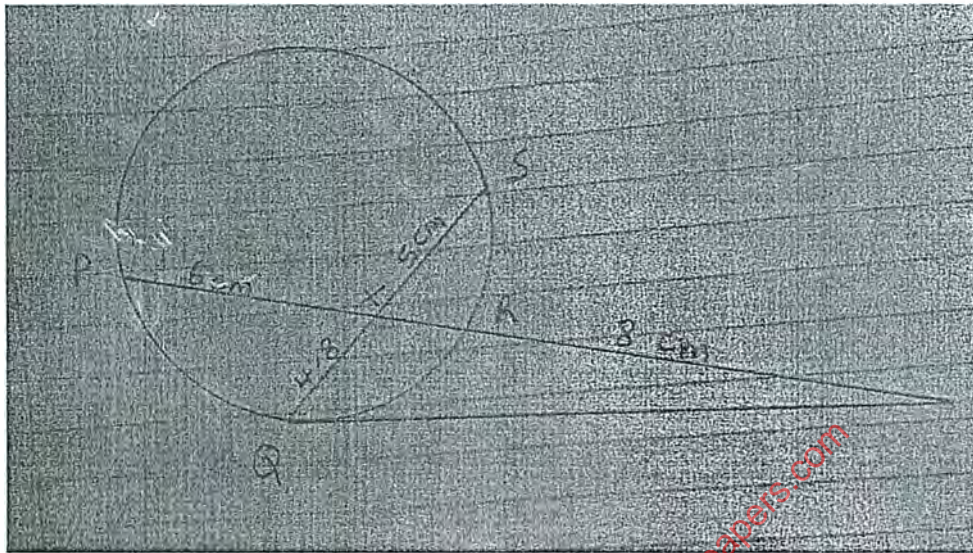
9. a) Expand $\left(\frac{2+x}{x}\right)^4$ (2 marks)

b) hence evaluate $\left(\frac{6}{5}\right)^4$ (2 marks)

10. Find the radius and the coordinate of the centre of a circle whose equation is $2x^2 + 2y^2 - 6x + 10y + 9 = 0$ (3 marks)

11. Brianwel and Denis working together can do a piece of work in 6 days. Brianwel working alone takes 5 days longer than Denis. How many days does it take Denis to do the work alone. (3 marks)

12. In the figure below, QT is a tangent to the circle at Q. PXRT and QXS are straight lines. PX=6cm, RT=8cm, QX=4.8cm and XS=5cm. Find the length of QT. (3 marks)



13. Given that $\cos 2\theta = \sqrt{3}\sin(2\theta)$, Find θ for $0^\circ \leq \theta \leq 150^\circ$ (3 marks)

14. A transformation is represented by matrix $R = \begin{pmatrix} x & -3 \\ 2 & 5x \end{pmatrix}$. R maps an object of area 10cm^2 onto an image of area 110cm^2 . Find the possible values of x. (3 marks)

15. Solomon invested ksh 8000 compounded quarterly at a rate of $r\%$ p.a. The value of the money after $2\frac{1}{4}$ years is ksh 18000. Determine the value of r . (4 marks)

16. The table below shows the number of goals scored in 40 soccer matches during a certain season.

No. of goals	0	1	2	3	4	5	6	7
No. of matches	2	9	6	8	6	5	2	2

Calculate the mean number of goals scored per match. (3marks)

SECTION II: 50 MARKS

Answer ONLY FIVE questions in this section

17. The table below shows income tax rate for a certain year

Monthly Income in ksh	Tax rate in %
0-10164	10 %
10165-19740	15 %
19741-29316	20 %
29317-38892	25 %
Over 38892	30 %

A tax relief of ksh 1162 per month was allowed. An employee's taxable income in the fifth bar was 2108.

(a) Calculate;

(i) The employee's total taxable income that month. (2 marks)

(ii) The tax payable by the employee in that month (5 marks)

(b) The employee's income included a house allowance of ksh 12,000 and a hardship allowance of ksh 3000. The employee contributed 5% of his basic salary to a cooperative society. Calculate the employees net pay for that month (3 marks)

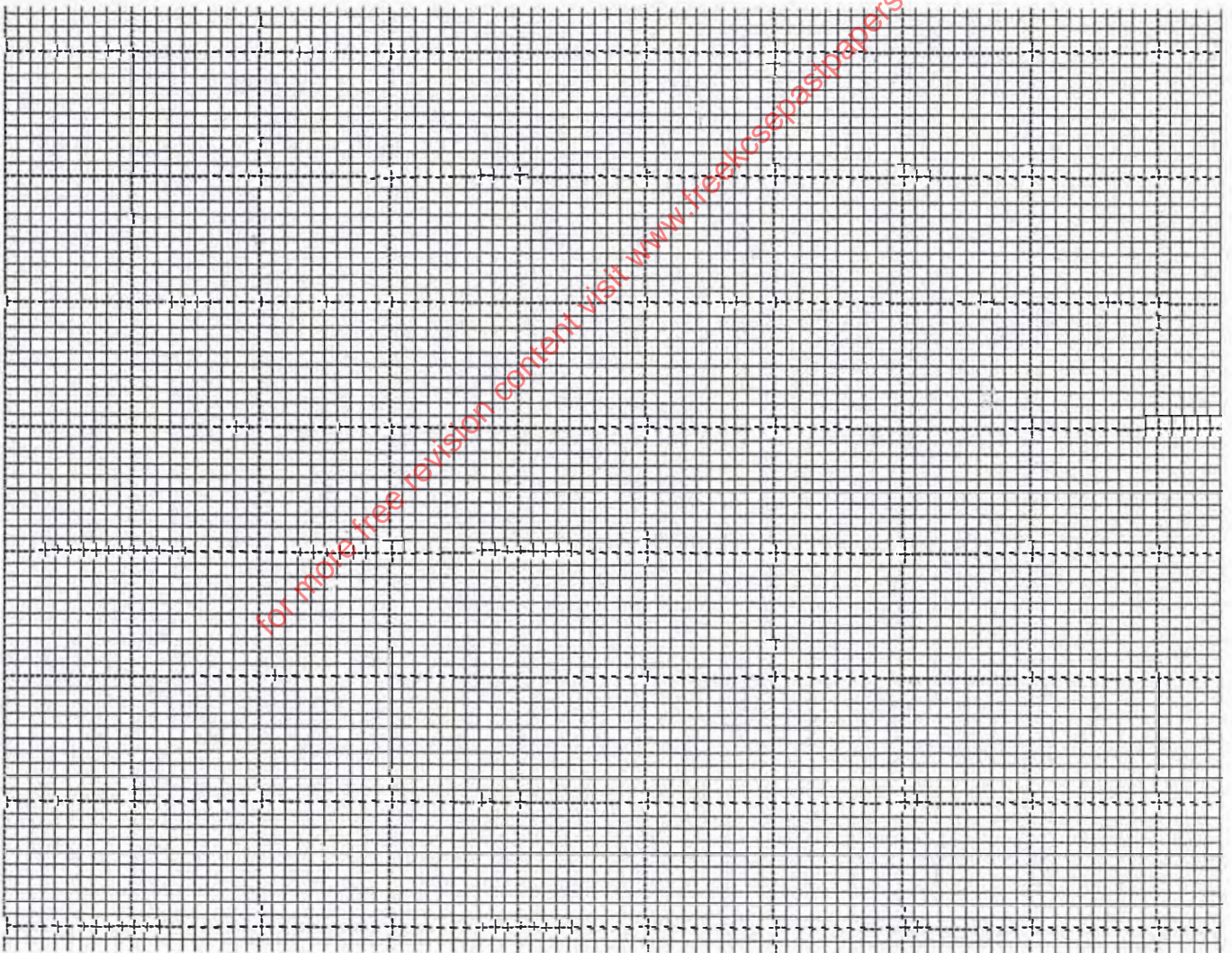
18. The points $A'B'C'$ are the images of $A(4,1)$ $B(0,-2)$ and $C(-2,4)$ respectively under a transformation represented by the matrix $M = \begin{bmatrix} -1 & 1 \\ 2 & -3 \end{bmatrix}$

(a) Write down the coordinate of $A'B'$ and C' hence plot triangle ABC and $A'B'C'$ on the same grid. (4 marks)

(b) $A''B''C''$ are the images of $A'B'C'$ respectively under another transformation whose matrix is $N = \begin{bmatrix} 2 & -1 \\ 1 & 2 \end{bmatrix}$

Write down the coordinate of $A''B''$ and C'' hence plot $A''B''C''$ (3 marks)

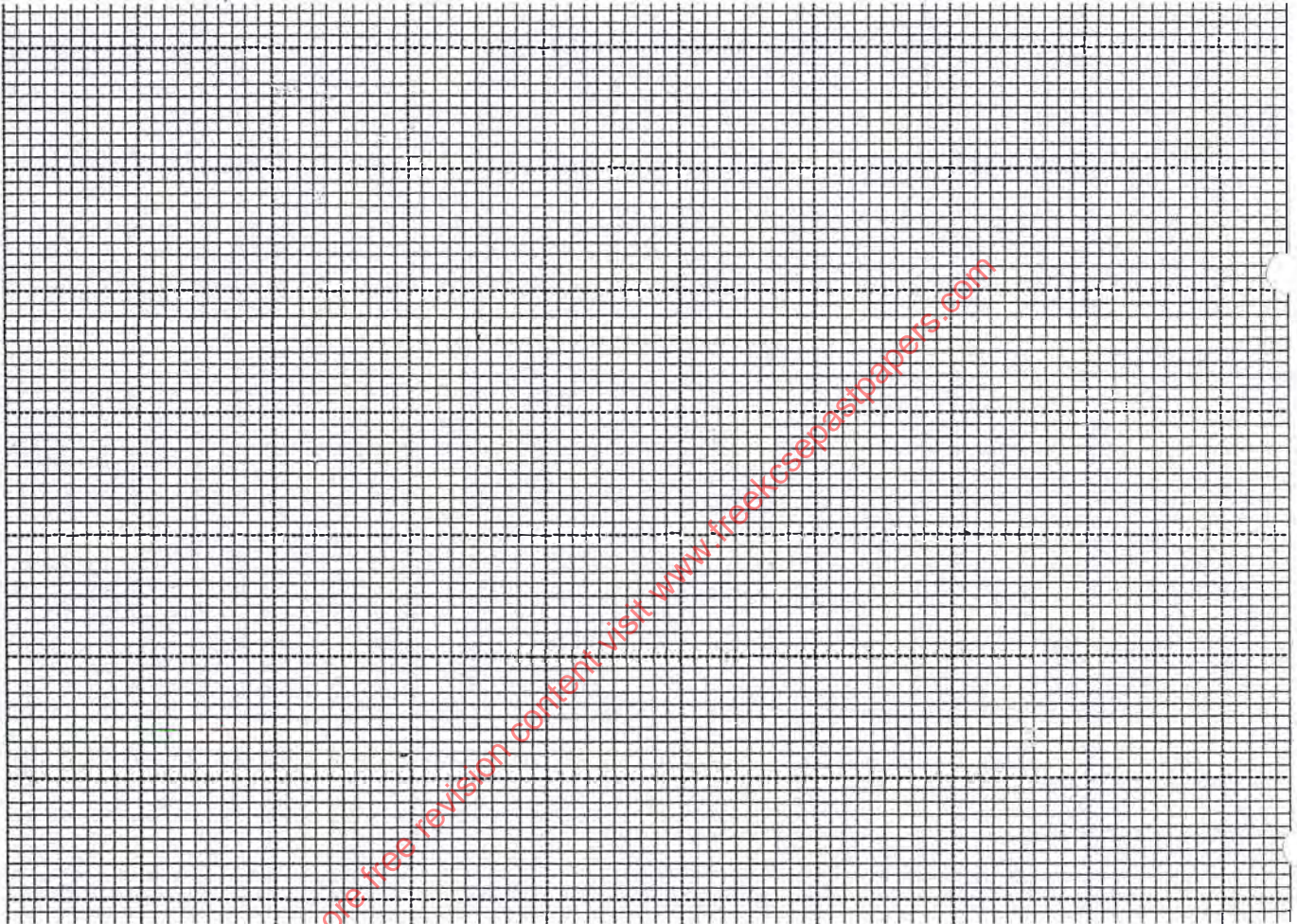
(c) Transformation M followed by N can be represented by a single transformation P . Determine matrix P (3 marks)



19. Complete the table below, giving your values correct to 2 d.p (3 marks)

x°	0°	30°	60°	90°	120°	150°	180°
$\text{Cos } 2x$	1	0.5	-0.5			0.5	
$\text{Sin}(x + 30^\circ)$	0.5		1	0.87			

Draw on the same axis the graph for $y = \text{Cos } 2x$ and $y = \text{Sin}(x + 30^\circ)$ (5 marks)



Use the two graphs to estimate the solutions of

(i) $\text{Sin}(x + 30^\circ) - \text{Cos } 2x = 0$ (1 mark)

(ii) $\text{Cos } 2x = 0.6$ (1 mark)

Determine the period of the two curves (1 mark)

20. The probability that our school will host soccer and rugby tournament this year is 0.8. If we host, the probability of winning soccer is 0.7. If we don't host the probability of winning soccer is 0.4. If we win soccer the probability of winning rugby is 0.8, otherwise if we lose the probability of winning rugby is 0.3

(a) Draw a tree diagram to represent this information (2 marks)

(b) Use the tree diagram to find

(i) The probability that we lose both games (2 marks)

(ii) The probability that we will win only one game (2 marks)

(iii) The probability that we will host and lose both games (2 marks)

(iv) The probability that we win at least one game if we host (2 marks)

21. The first, 4th and 15th terms of an arithmetic progression, (AP) forms the first three consecutive terms of an increasing geometric progression (GP).

Given that the first term of the AP is 'a' and the common difference is 'd'.

(a) Write down the first three terms of the GP in terms of a and d (1 mark)

(b) The sum of the 3rd and 11th term of AP is 30

Calculate

(i) The common difference of the AP. (5 marks)

(ii) The first term of the AP (1 mark)

(iii) The common ratio of the GP (1 mark)

(iv) The sum of the first 10 terms of the GP

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22. The quantities P , Q and R are such that P varies directly as the square of Q and inversely as the square root of R

(a) Given that $P = 72$ when $Q = 6$ and $R = 16$

Find

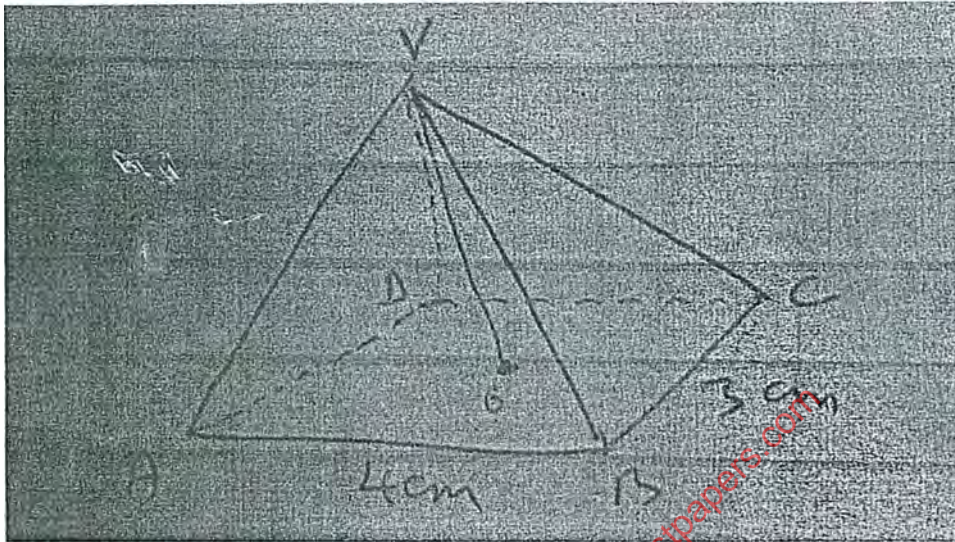
(i) The law connecting P , Q and R (3 marks)

(ii) The value of P when $Q = 8$ and $R = 4$ (2 marks)

(iii) If Q increases by 25% and R decreases by 36%. Find the percentage change in P . (5 marks)

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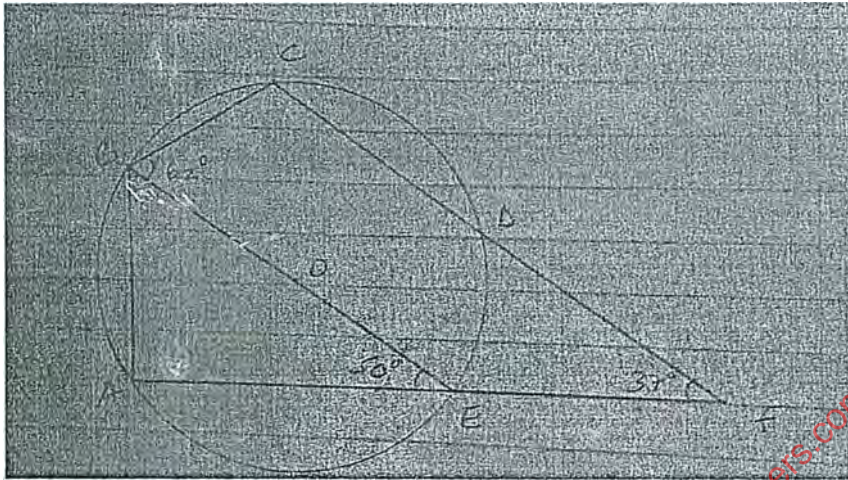
23. The diagram below shows a right pyramid $VABCD$ with V as vertex. The base of the Pyramid is rectangle $ABCD$ with $AB = 4\text{cm}$, $BC = 3\text{cm}$. The height of the pyramid is 6cm



Calculate

- (i) The length of the projection of VA on the plane $ABCD$. (3 marks)
- (ii) The angle between the face VAB and the base (3 marks)
- (iii) P is the midpoint of VC and O is the midpoint of VD . Find the angle between the planes VAB and $ABPQ$ (4 marks)

24. In the figure below, BOE is the diameter of the circle, $\angle AEB = 50^\circ$, $\angle CBE = 62^\circ$, and $\angle DFE = 37^\circ$



Giving reasons calculate the following angles

- (a) $\angle CDE$ (2 marks)
- (b) Reflex $\angle COE$ (2 marks)
- (c) $\angle EAB$ (2 marks)
- (d) $\angle ADE$ (2 marks)
- (e) $\angle DCE$ (2 marks)

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