

NYANDARUA WEST JOINT EXAMINATION

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

CANDIDATES SIGNATURE:.....

DATE:.....

121/2

MATHEMATICS

PAPER 2

JULY 2018

Time: 2 ½ hours

Instructions to candidates

- (a) Write your name and Admission 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 1** and **Section II**.
- (d) Answer **ALL** the questions in **Section I** and **only five** questions 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.
- (i) **This paper consists of 14 printed pages.**
- (j) **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 1

| 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)

1. The length and width of a rectangular land were measured as 14.5cm and 10.5cm respectively.

Find the percentage error in its area. (3 marks)

2. Solve the following equation (3 marks)

$$\sin(2\theta - 30^\circ) = \frac{\sqrt{3}}{2} \text{ for } 0^\circ \leq \theta \leq 180^\circ$$

3. Make n the subject (3 marks)

$$y = \frac{mn}{m-n}$$

4. Find the centre and the radius of a circle whose equation is

$$x^2 - 6x + y^2 - 10y + 30 = 0 \quad (3 \text{ marks})$$

5. A variable y varies as the square of x and inversely as the square root of z .

Find the percentage change in y when x is increased by 5% and z reduced by 19%
(4 marks)

6. A shopkeeper mixes sugar costing Ksh.40 per kg with another type which costs Ksh.60 per kg. Find the ratio in which the two types should be mixed such that if the mixture is sold at Ksh.55, a profit of 10% is realised.
(2 marks)

7. Under a transformation whose matrix $y = \begin{pmatrix} x-2 & -2 \\ x & x \end{pmatrix}$ a triangle whose area is

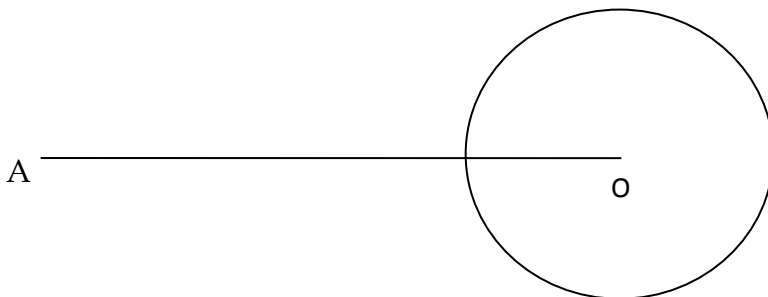
12.5cm^2 is mapped onto a triangle whose area is 50cm^2 . Find two possible values of x .
(3 marks)

8. The expression $3x^2 - 8x$ defines the gradient of a curve which passes through (1,1). Determine its equation. (3 marks)

9. Solve the equation (3 marks)

$$12^x \times 24^y = 216$$

10. The diagram below shows a circle centre O. A point P lies on the line AO such that a tangent from the point P to the circle makes an angle of 30° with the line AO. By construction, locate the point P hence measure the length PO. (3 marks)



11. Determine the amplitude, period and phase angle for the function (3 marks)

$$y = 6 \sin \left(\frac{x}{2} - 90^\circ \right)$$

12. A bag contains 10 balls of which 3 are red, 5 are white and 2 are green. Another bag contains 12 balls of which 4 are red, 3 white and 5 green. A bag is chosen at random and then a ball chosen at random from the bag. Find the probability that the ball chosen is red. (4 marks)

13(a) Write down the first four terms of the expansion $\left(2 - \frac{1}{4}x\right)$ in ascending powers of x , giving the answer in simplest form. (2 marks)

(b) Use the expansion in (a) above to find the value of $(1.975)^{10}$ to the nearest whole number. (2 marks)

14. The fifth term of an arithmetic progression is 11 and the twenty fifth term is 51. Calculate the first term and the common difference. (3 marks)

15. Solve for x in the equation (3 marks)

$$\frac{1}{2} \log_2 81 + \log_2 \left(x^2 - \frac{x}{3}\right) = 1$$

16. Simplify $\frac{\sqrt{5}}{\sqrt{5-\sqrt{3}}} - \frac{\sqrt{5}}{\sqrt{5+\sqrt{3}}}$ (3 marks)

SECTION 2 (50 MARKS)

ANSWER ONLY FIVE QUESTIONS.

17. In a triangle ABC, angle BAC = 47° , AC = 5cm and AB = 7cm, calculate;

(a)(i) Angle ABC (4 marks)

(ii) The area of triangle ABC (2 marks)

(b) Grace and Janet stand on opposite sides of a vertical tower 60m high. The angle of elevation of the top of the tower from Grace and Janet are 75° and 65° respectively. Calculate the distance between Grace and Janet. (4 marks)

18. The position of two towns P(60°N,29°W) and Q(60°N,31°E) are give above.

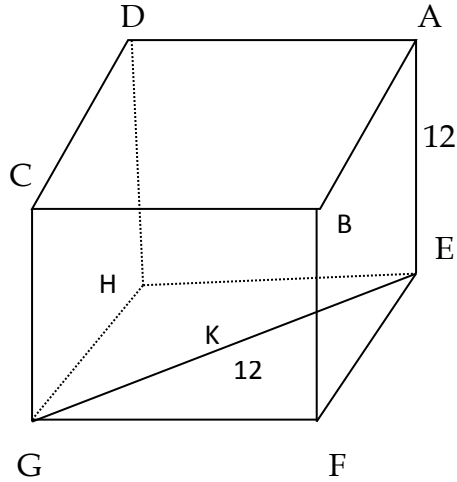
(i) Calculate the distance between the two towns a long parallel of latitude. Take $R=6370$
and $\pi = \frac{22}{7}$ (3 marks)

(ii) If it is 1200hrs at P, what is the local time at Q. (3 marks)

(b) An aeroplane flew due South from a point A(60°N, 45°E) to point B. The distance covered by the aeroplane was 800km.

Determine the position of B. (4 marks)

19. In the figure below, ABCDEFGH is a cuboid with a square base. $EG = 5\text{cm}$, $AE = 12\text{cm}$ and K is the midpoint of EG.



Calculate:

(i) The length AG. (2 marks)

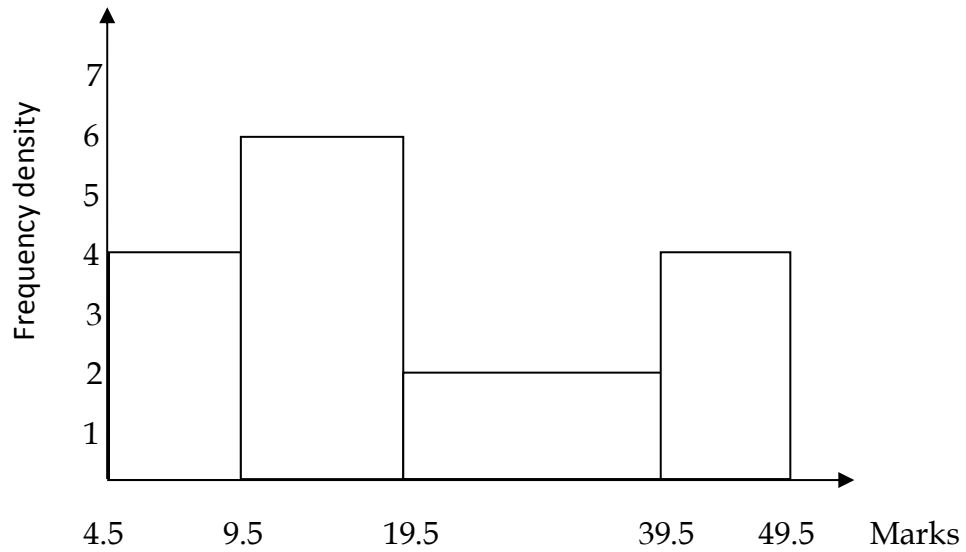
(ii) The angle between the line AG and the base. (2 marks)

(iii) The angle between the plane AHF and the base. (2 marks)

(iv) The length CF. (2 marks)

(v) The volume of the cuboid. (2 marks)

20. The diagram below shows a histogram representing marks obtained in a certain test;



(a) Develop a frequency distribution table. (4 marks)

(b) Calculate the mean. (3 marks)

(c) Calculate the standard deviation. (3 marks)

21(a) Using a ruler and a pair of compasses only. Construct triangle ABC in which

$AB = 5\text{cm}$, $BC = 4.5\text{cm}$ and $\angle BAC = 60^\circ$ (3 marks)

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

(i) determine the locus of a point P such that $\angle APB = 60^\circ$ (3 marks)

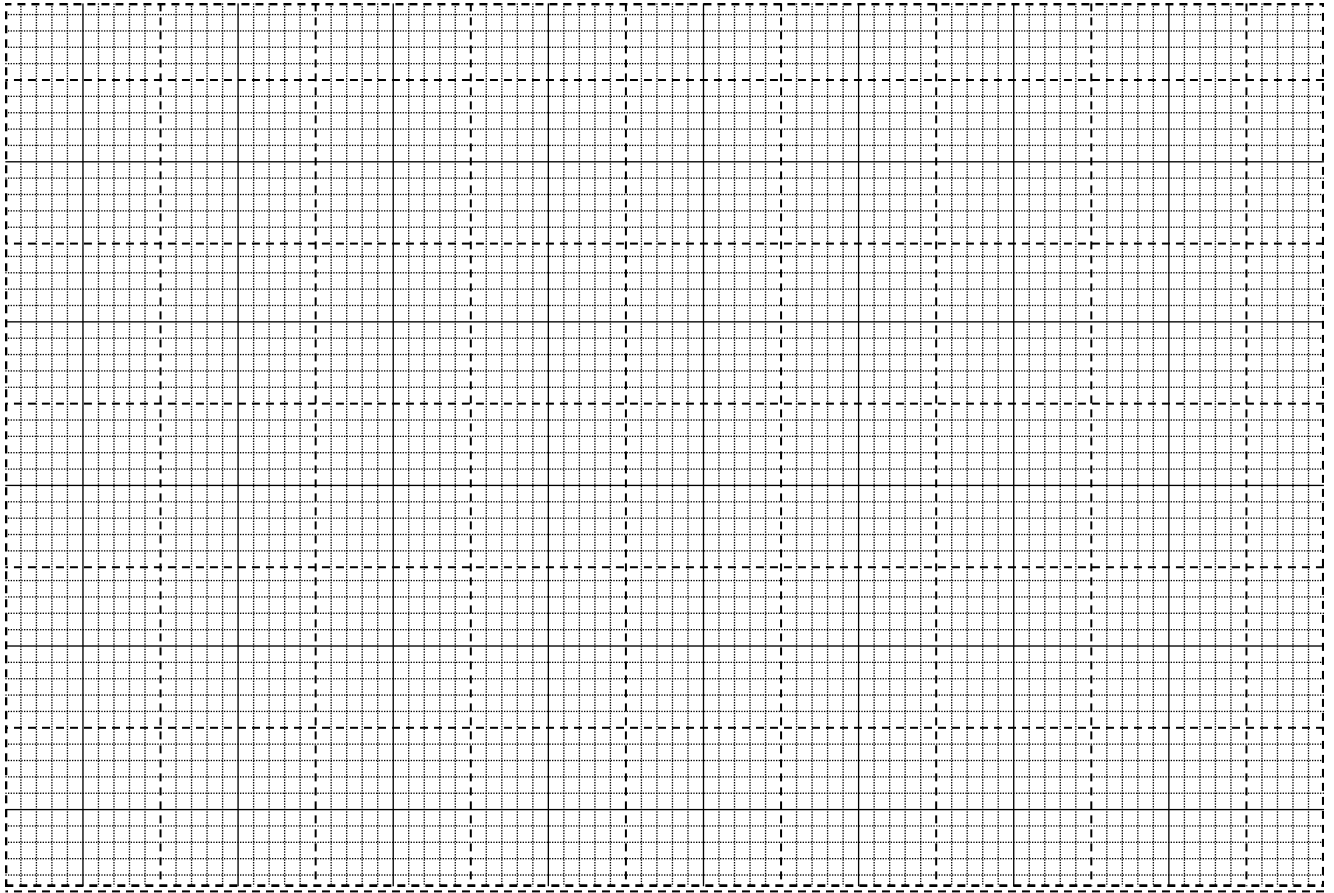
(ii) construct the locus R such that $AR \geq 2\text{cm}$ (2 marks)

(iii) Determine the region T such that $\angle ACT \geq \angle BCT$ (2 marks)

22. A triangle has vertices

$A(-5,-2)$, $B(-3,-2)$ and $C(-5,-5)$

(a)(i) On the grid provided, draw triangle ABC and its image $A^1B^1C^1$ under rotation of $+90^\circ$ about the origin and write its co-ordinates. (3 marks)



(ii) Find $A^{11}B^{11}C^{11}$ the image of $A^1B^1C^1$ under reflection on the line $y+x=0$ and write its co-ordinates. (3 marks)

(b)(i) Describe a single transformation that maps ΔABC onto $\Delta A^{11}B^{11}C^{11}$ (2 marks)

(ii) Find its matrix (2 marks)

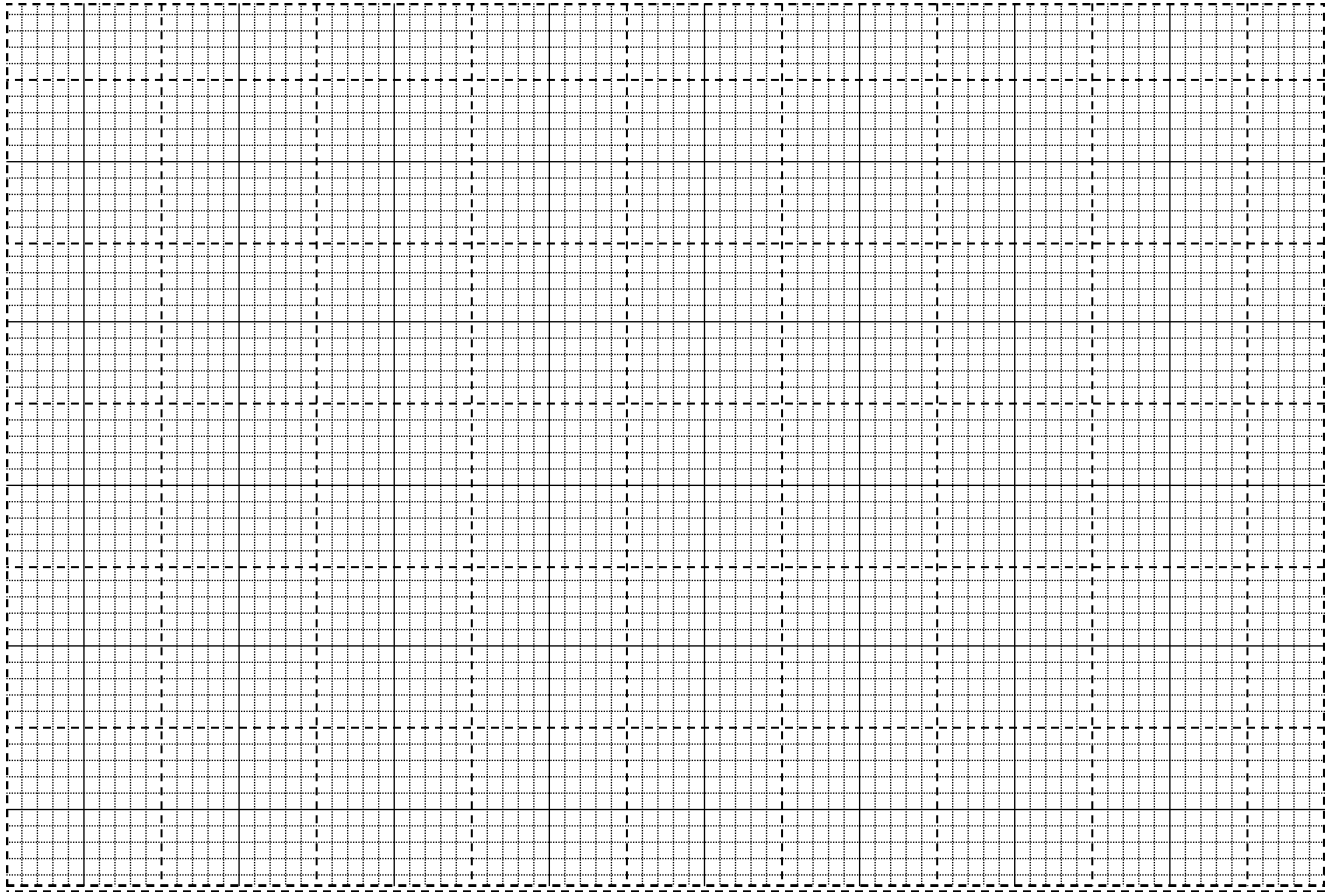
23(a) Complete the table below.

| | | | | | | | | | |
|---|---|-----|------|-------|------|-----|------|-----|-------|
| x | 0 | 30° | 60 | 90 | 120 | 150 | 180 | 210 | 240 |
| $2 \cos \left(\frac{1}{2}x - 30^\circ \right)$ | | | 2.00 | | 1.73 | | | | |
| $2 \cos 2x$ | | | | -2.00 | | | 2.00 | | -1.00 |

(b) On the grid provided on the same axes, draw the graph of

$$y = 2 \cos \left(\frac{1}{2}x - 30^\circ \right) \text{ and } y = 2 \cos 2x$$

Use a scale of 2cm rep 30° on the x - axis and 1cm rep 0.5cm on the y axis. (5 marks)



(c) Use your graph to solve the equation.

(i) $2 \cos \left(\frac{1}{2}x - 30^\circ \right) = 1.1$

(2 marks)

(ii) $\cos 2x - \cos \left(\frac{1}{2}x - 30^\circ \right) = 0$

(1 mark)

24. The velocity of a particle after t seconds is given by $v = t^2 - 2t + 4$

(a) Use the mid ordinate rule with six strips to estimate the displacement of the particle between $t = 1$ and $t = 13$ (3 marks)

(b) Determine (i) the exact area of the particle between $t = 1$ and $t = 13$. (3 marks)

(iii) accelerate of the particle at $t = 4$ (2 marks)

(c) Calculate the percentage error arising from the estimated area in (a) above. (2mks)