Name ....

Index Number ....

School ....

Candidate's Signature ....

121/2

Date ....

MATHEMATICS

Paper 2

2015

2½ hours

MAKUENI COUNTY KCSE 2015 PREPARATORY EXAMINATION

Kenya Certificate of Secondary Education

MATHEMATICS

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 the 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)   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) **This paper consists of 24 printed pages**.

(i)   Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

(j)   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	

Sponsored by H.E. Prof. Kivutha Kibwana, Governor, Makueni County.

Section I (50 marks)

*Answer **all** the questions in this section in the space provided.*

1. Use logarithms to evaluate:

$$\frac{16.49^2 \times \sqrt{0.6318}}{327.5}.$$ (4 marks)

2. Simplify the expression (3 marks)

$$\frac{4x^2 - y^2}{3y^2 - 7xy + 2x^2}.$$

3. Wambua saves 1,040 shillings in the first year of his employment and each year afterwards saves 145 more than the preceding year. How much will he have saved by the time he retires in 30 years' time? (3 marks)
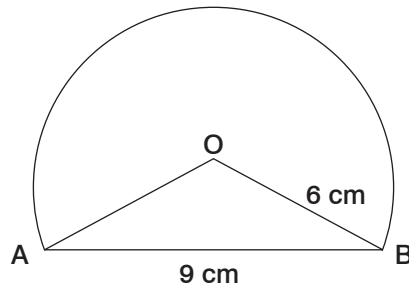
4. Given that $y(cx^2 - a) = b - bx^2$, make x the subject. (3 marks)

5. The gradient of a curve at any point is given by $2x - 1$. Given that the curve passes through point $(1, 5)$, find the equation of the curve. (2 marks)

6. In the figure below, O is the centre of a circle whose radius is 6 cm. AB = 9 cm and $\angle$AOB is obtuse. Calculate the area of the major segment. (4 marks)

7. (a) Expand $(1 - \frac{1}{2}x)^5$ up to the term with x^3. (2 marks)

(b) Use your expansion in (a) above to determine the value of $(0.99)^5$. (2 marks)

8. The length and breadth of a rectangular floor were measured and found to be 5.2 m and 2.4 m, respectively. If a possible error of 0.01 m was made in each of the measurements, find the:

(a) maximum possible area and minimum possible area of the floor. (2 marks)

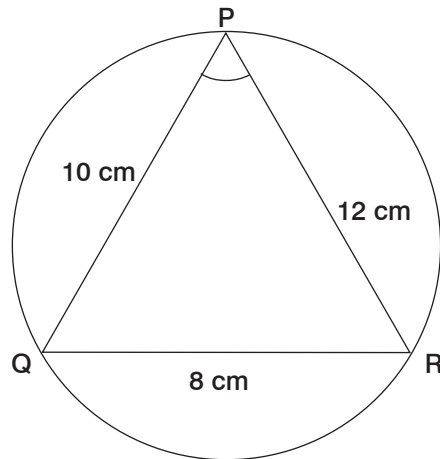(b) maximum possible wastage in a carpet ordered to cover the whole floor.   (1 mark)

9. Simplify: (3 marks)

$$\frac{4}{\sqrt{5} + \sqrt{2}} - \frac{3}{\sqrt{5} - \sqrt{2}}.$$

10. In the diagram below, P, Q and R are points on the circumference of a circle. PQ = 10 cm, PR = 12 cm and QR = 8 cm.   (3 marks)

Find the radius of the circle to 2 decimal places.

11. Under a transformation given by the matrix $\begin{pmatrix} 2x & x+3 \\ 1 & x+3 \end{pmatrix}$, a rectangle is wrapped onto a straight line. Find the value of x. (3 marks)

12. Solve $4 - 4\cos^2 \alpha = 4\sin \alpha - 1$ for $0 \leq \alpha \leq 360$. (4 marks)

13. Find the distance between the centre A of a circle whose equation is $2x^2 + 2y^2 + 6x + 10y + 7 = 0$ and the point B(-4, 1). (3 marks)

14. Three grades A, B and C of rice were mixed in the ratio 3:4:5. The cost per kilogram of each of the grades A, B and C was Ksh 120, Ksh 90 and Ksh 60, respectively. Calculate the cost of one kilogram of the mixture. (2 marks)

15. Three quantities p, x and y are such that p varies directly as x and inversely as the square root of y. Find the percentage change in p if x decreases by 7% when y increases by 21%. (3 marks)

16. A black die and a red die are rolled. What is the probability of getting a total score of 5 or 8? (3 marks)

SECTION II (50 marks)

*Answer only **five** questions in this section in the spaces provided.*

17. The table below shows the rate at which tax is charged on annual income.

Annual taxable income (kf)	Rate in Ksh per kf
1 – 1800	2
1801 – 3600	3
3601 – 5400	5
5401 – 7200	7
7201 – 9000	9
9001 – 10800	10
10801 – 12600	12
Over 12600	13

(a) A company employee earns a gross monthly salary of Ksh 12, 600. He is housed by the company and as a result his taxable income is increased by 15%. If he is married and hence claims a relief of Ksh 1,162 per month, find the amount of tax he pays per year and his net salary per month.

(7 marks)

(b) If the employee was given a 50% pay rise, calculate the percentage increase on income tax.

(3 marks)

18. (a) Complete the table below, giving the values correct to 2 decimal places. (2 marks)

$x°$	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Sin $2x$	0		0.87		− 0.87		0	0.87	0.87				0
$3\cos x - 2$	1	0.60		− 2	− 3.5			− 4.60			− 0.5		1

(b) On the graph paper provided, draw the graphs $y = \sin 2x$ and $y = 3\cos x - 2$ for $0° \le x \le 360°$ on the same axes. Use a scale of 1 cm to represent 30° on the x-axis and 2 cm to represent 1 unit on the y-axis.

(5 marks)

(c) Use the graph in (b) above to solve the equation $3\cos x - \sin 2x = 2$. (2 marks)

(d) State the amplitude of $y = 3\cos x - 2$. (1 mark)
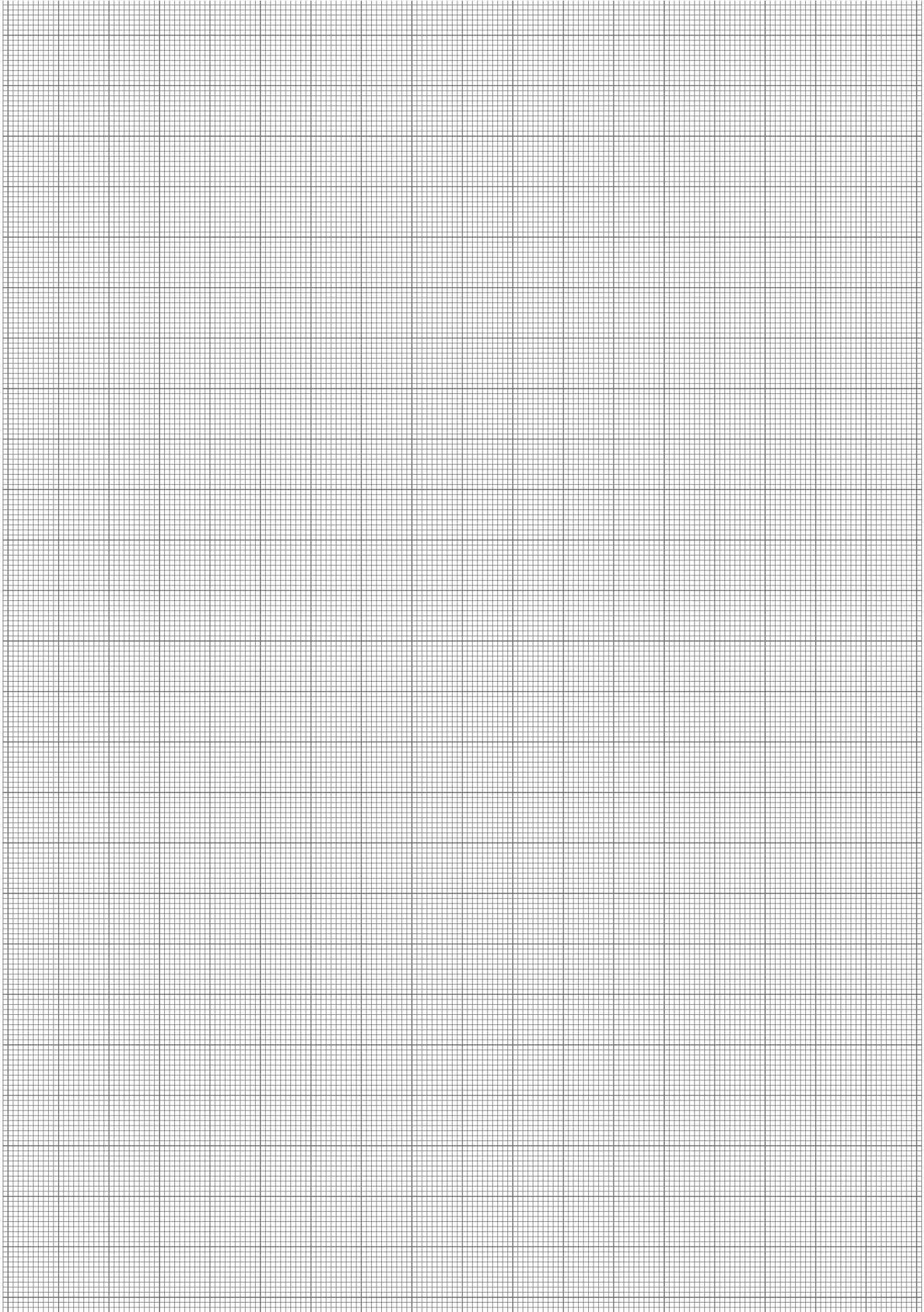
19. The figure below represents a right pyramid with vertex V and a rectangular base PQRS. VP = VQ = VR = VS = 18 cm. PQ = 16 cm and QR = 12 cm. M and O are the mid-points of QR and PR, respectively.
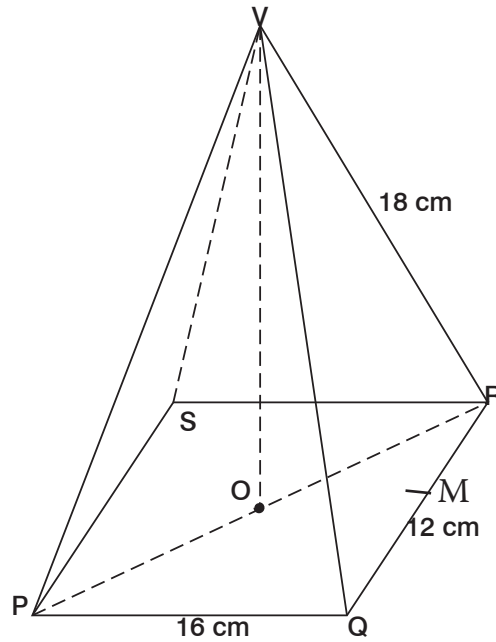
(a) Calculate the:

(i) length of the projection of line VP on the plane PQRS. (2 marks)

    (ii) angle between line VP and the plane PQRS.   (2 marks)
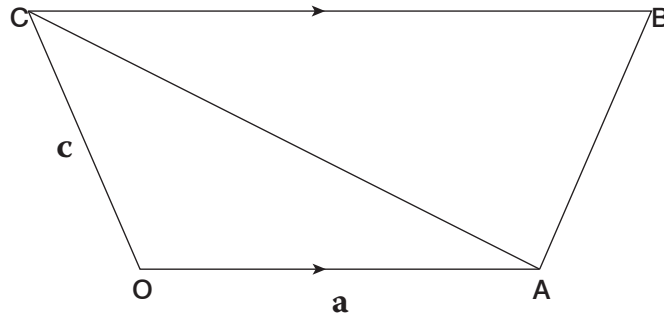
(b) Calculate the angle between the face VQR and the base PQRS.   (4 marks)

(c) Calculate the volume of the pyramid.   (2 marks)

20. The diagram below shows a trapezium OABC. $\overline{OA}$ = **a**, $\overline{OC}$ = **c** and CB = 3**a**. X and Y are points on AC such that AX:XC = 1:2 and AY:YC = 1:3.

(a) Give the following vectors in terms of **a** and **c**.
   (i) $\overline{AC}$ (1 mark)

   (ii) AY (1 mark)

   (iii) $\overline{OY}$ (1 mark)

(iv) $\overline{OX}$ (1 mark)

(v) $\overline{AB}$ (1 mark)

(b) Hence show that the points O, Y and B are collinear. (4 marks)

(c) In what ratio does the diagonal $\overline{OB}$ cut $\overline{AC}$? (1 mark)

21. The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r:

(a) explain r in terms of a. (3 marks)

(b) Given that the sum of the three terms is 14,

    (i) find the values of a and r and hence write down two possible sequences each up to the 4th term. (5 marks)

(ii) find the product of the 50th terms of the two sequences. (2 marks)

22. Two points A and B are found on the earth's surface. The position of A is (52°S, 66°W) and B (52°S, 114°E). Use Earth's radius as 6 370 km.

(a) Find the longitude difference between A and B. (1 mark)

(b) Calculate the shortest distance between A and B along:
   (i) the latitude in kilometres to the nearest whole number. (2 marks)

(ii) the longitude in kilometres to the nearest whole number.   (3 marks)

(c) A plane travelling at 800 km/h leaves point A at 10.00 a.m. and flies through South Pole to point B. Find the local time the plane arrives at point B to the nearest minutes.   (4 marks)

23. The diagram below shows a sketch of the line $y = 3x$ and the curve $y = 4 - x^2$ intersecting at points P and Q.
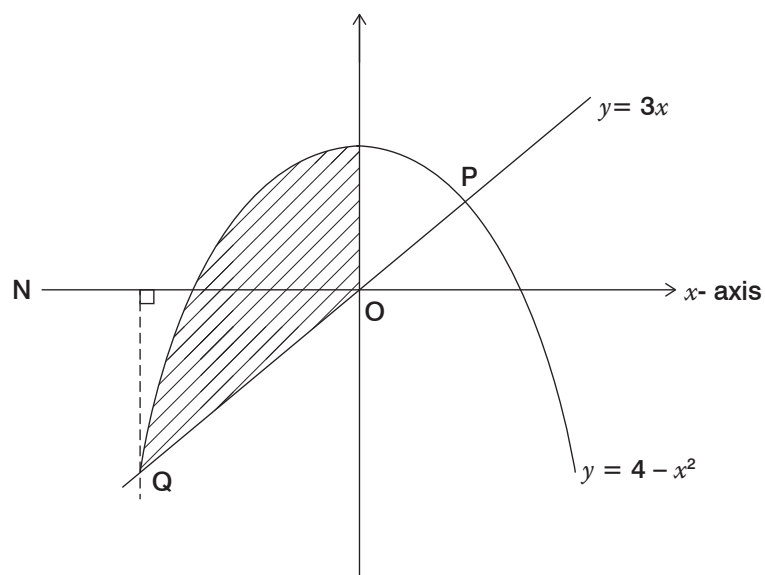
(a) Find the coordinates of P and Q. (3 marks)

(b) Given that QN is perpendicular to the x-axis at N, calculate:

(i) the area bound by the curve y = $4 - x^2$ and the x-axis. (2 marks)

(ii) the area of the shaded region that lies below the x-axis. (2 marks)

(iii) the area of the shaded region enclosed by the curve $y = 4 - x^2$, the line $y = 3x$ and the y-axis.

(3 marks)

24. A factory manufactures two types of tables; A and B. Type A table requires 2 hours for painting and 4 hours for assembling. Type B table requires 2 hours for assembling and 5 hours for painting. There are 48 hours for assembling and 60 hours for painting. The number of type B tables must be at least 3 and less than twice the number of type A tables. Profit on type A table is sh 180 and profit on type B table is sh 120. If x represents the number of type A tables and y represents the number of type B tables:

(a) form all inequalities representing the information above. (3 marks)

(b) illustrate the inequalities on the grid provided by shading the unwanted region.   (4 marks)

(c) Determine the number of tables of each type which can be manufactured to make maximum
     profit and determine the maximum profit.   (3 marks)