

Name **002055101** Index Number /

121/1
MATHEMATICS ALT. A
 Paper 1
 Oct./Nov. 2014
 2½ hours

Candidate's Signature
 Date



THE KENYA NATIONAL EXAMINATIONS COUNCIL
 Kenya Certificate of Secondary Education
 MATHEMATICS ALT A
 Paper 1
 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** questions from **Section II**.
- (e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided 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 **20 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

SECTION I (50 marks)

Answer **all** the questions in this section in the spaces provided,

1. Ntutu had cows, sheep and goats in his farm. The number of cows was 32 and number of sheep was twelve times the number of cows. The number of goats was 1344 more than the

number of sheep. If he sold $\frac{1}{3}$ of the goats, find the number of goats that remained. (4 marks)

2. Use the prime factors of 1764 and 2744 to evaluate

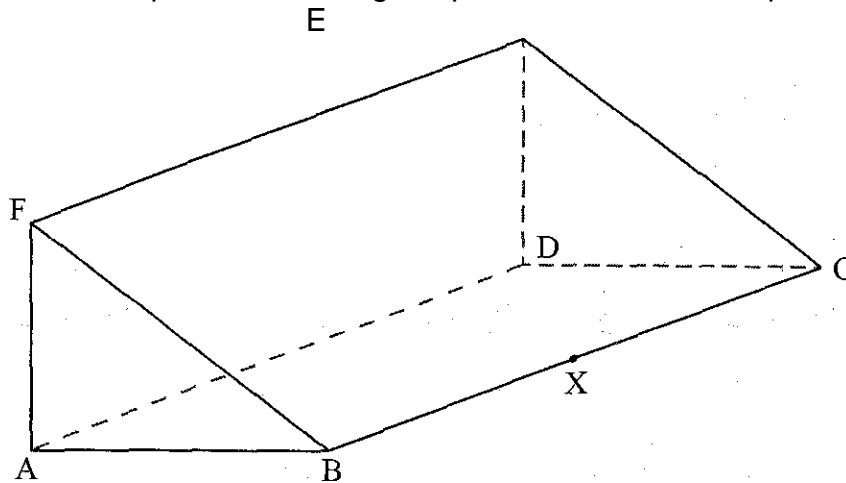
$$\frac{\sqrt{1764}}{\sqrt[3]{2744}}$$

(3 marks)

3. The mass of a solid cone of radius 14cm and height 18cm is 4.62 kg. Find its density in g/cm^3 .

(3 marks)

4. The figure below represents a triangular prism ABCDEK X is a point on BC.



(a) Draw a net of the prism. (2 marks)

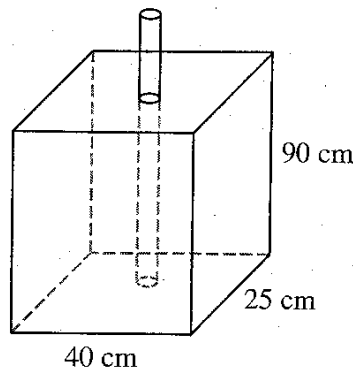
(b) Find the distance DX. (1 mark)

5. A businessman makes a profit of 20% when he sells a carpet for Ksh 36 000. In a trade fair he sold one such carpet for Ksh 33 600. Calculate the percentage profit made on the sale of the carpet during the trade fair. (3 marks)

6. Simplify

$$\frac{243^{\frac{-2}{5}} \times 125^{\frac{2}{3}}}{9^{\frac{-3}{2}}}$$

7. The area of a sector of a circle, radius 2.1 cm, is 2.31 cm^2 . The arc of the sector subtends an angle θ , at the centre of the circle. Find the value of θ in radians correct to 2 decimal places. (2 marks)
8. Expand and simplify $(x + 2y)^2 - (2y - 3)^2$. (2 marks)
9. A plane leaves an airstrip L and flies on a bearing of 040° to airstrip M 500m away, The plane then flies on a bearing of 316° to airstrip N The bearing of N from L is 350° . By Scale drawing, determine the distance between airstrips M and N (4 marks)
10. The sum of interior angles of a regular polygon is 1800° . Find the size of each exterior angle. (3 marks)
11. A cow is 4 years 8 months older than a heifer. The product of their ages is 8 years. Determine the age of the cow and that of the heifer. (4 marks)
12. Solve $4 \leq 3x - 2 < 9 + x$ hence list the integral values that satisfies the inequality. (3 marks)
13. The figure below shows a rectangular container of dimensions 40cm by 25cm by 90cm. A cylindrical pipe of radius 7.5 cm is fitted in the container as shown.



Water is poured into the container in the space outside the pipe such that the water level is 80% the height of the container. Calculate the amount of water, in litres, in the container correct to 3 significant figures. (4 marks)

14. A minor arc of a circle subtends an angle of 105° at the centre of the circle. If the radius of the circle is 8.4cm, find the length of the major arc. (Take $\pi = \frac{22}{7}$) (3 marks)

15. Twenty five machines working at a rate of 9 hours per day can complete a job in 16 days.
A contractor intends to complete the job in 10 days using similar machines working at a rate of 12 hours per day. Find the number of machines the contractor requires to complete the job.

(3 marks)

16. Points A (-2, 2) and B(- 3, 7) are mapped onto A'(4, - 10) and B'(0, 10) by an enlargement. Find the scale factor of the enlargement.
(3 marks)

SECTION II (50 marks)

Answer only five questions in this section in the spaces provided

17. A line L passes through points (- 2, 3) and (- 1, 6) and is perpendicular to a line P at (- 1, 6).

(a) Find the equation of L. (2 marks)

(b) Find the equation of P in the form $ax + by = c$, where a, b and c are constants. (2 marks)

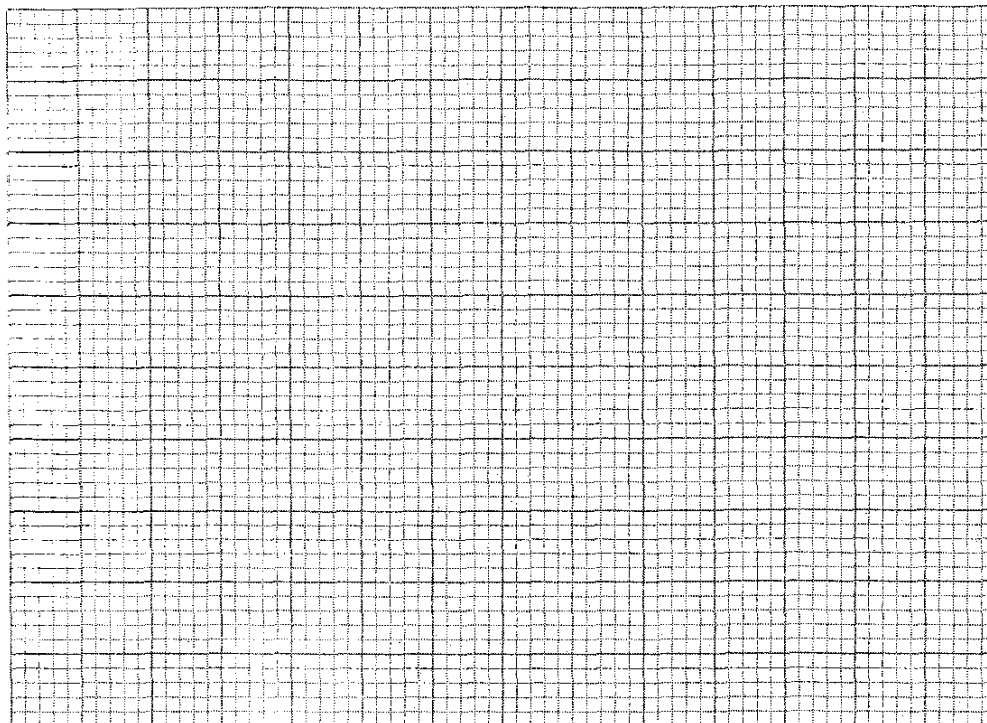
(c) Given that another line Q is parallel to L and passes through point (1,2), find the x and y intercepts of Q. (3 marks)

(d) Find the point of intersection of lines P and Q. (3 marks)

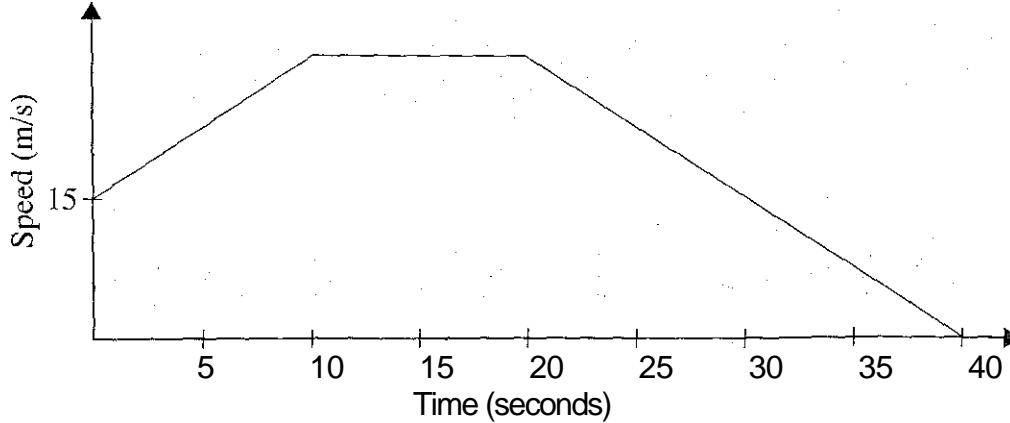
18 The lengths, in cm, of pencils used by pupils in a standard one class on a certain day were recorded as follows.

3	7	9	9	20	14	10	6	8	13
14	3	17	13	8	12	5	15	14	15
7	12	11	6	10	19	9	14	6	9
10	16	13	9	12	11	10	7	10	11

- (a) Using a class width of 3, and starting with the shortest length of the pencils, make a frequency distribution table for the data. (2 marks)
- (b) Calculate:
 - (i) the mean length of the pencils; (3 marks)
 - (ii) the percentage of pencils that were longer than 8 cm but shorter than 15 cm. (2 marks)
- (c) On the grid provided, draw a frequency polygon for the data. (3 marks)

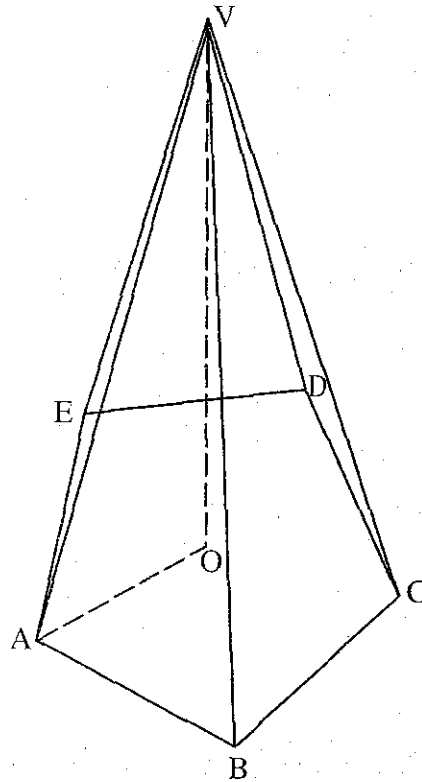


- 19 The figure below represents a speed time graph for a cheetah which covered 825 m in 40 seconds.



- (a) State the speed of the cheetah when recording of its motion started. (1 mark)
- (b) Calculate the maximum speed attained by the cheetah. (3 marks)
- (c) Calculate the acceleration of the cheetah in:
- the first 10 seconds; (2 marks)
 - the last 20 seconds. (1 mark)
- (d) Calculate the average speed of the cheetah in the first 20 seconds. (3 marks)

- 20 . The figure below shows a right pyramid VABCDE. The base ABCDE is a regular pentagon, $AO = 15$ cm and $VO = 36$ cm.



Calculate:

- (a) the area of the base correct to 2 decimal places; (3 marks)
- (b) the length AV; (1 mark)
- (c) the surface area of the pyramid correct to 2 decimal places; (4 marks)
- (d) the volume of the pyramid correct to 4 significant figures. (2 marks)

21. (a) Complete the table below for the function $y = x^2 - 3x + 6$ in the range $-2 \leq x \leq 8$. (2 marks)

X	-2	-1	0	1	2	3	4	5	6	7	8
y											

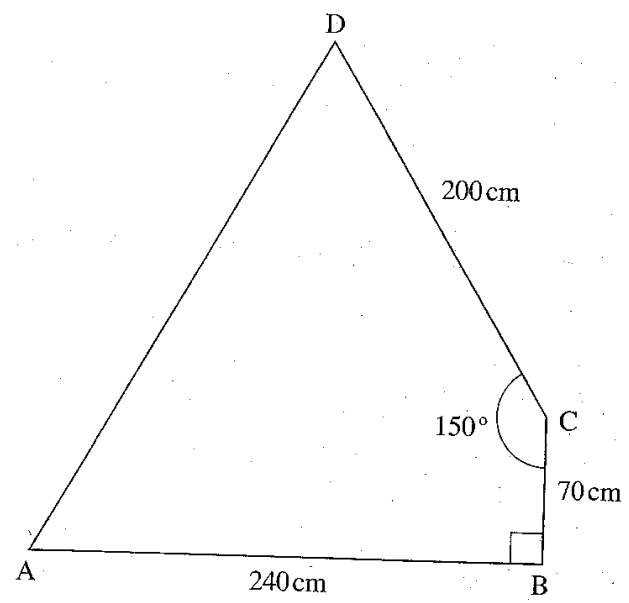
- (b) Use the trapezium rule with 10 strips to estimate the area bounded by the curve, $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$, and the x-axis. (3 marks)

- (c) Use the mid-ordinate rule with 5 strips to estimate the area bounded by the curve, $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$ and the x-axis. (2.marks)
- (d) By integration, determine the actual area bounded by the curve $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$, and the x-axis. (3 mark)

22. Using a pair of compasses and ruler only, construct:

- (i) triangle ABC in which $AB = 5\text{cm}$, $\angle BAC = 30^\circ$ and $\angle ABC = 105^\circ$; (3 marks)
 - (ii) a circle that passes through the vertices of the triangle ABC. Measure the radius. (3 marks)
 - (iii) the height of triangle ABC with AB as the base. Measure the height. (2 marks)
- (b) Determine the area of the circle that lies outside the triangle correct to 2 decimal places. (2 marks)

23. The figure below represents a piece of land in the shape of a quadrilateral in which $AB = 240\text{m}$, $BC = 70\text{ m}$, $CD = 200\text{m}$, $\angle BCD = 150^\circ$ and $\angle ABC = 90^\circ$.



Calculate
(a) the size of $\angle BAC$ correct to 2 decimal places; : (2 marks)

(b) the length AD correct to one decimal place; (4 marks)

(c) the area of the piece of land, in hectares, correct to 2 decimal places. (4 marks)

24 The equation of a curve is given by $y = x^3 - 4x^2 - 3x$.

(a) Find the value of y when $x = -1$ (1 mark)

(b) Determine the stationary points of the curve. (5 marks)

(c) Find the equation of the normal to the curve at $x = 1$. (4 marks)

Name Index Number

121/2
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SECTION I (50 marks)

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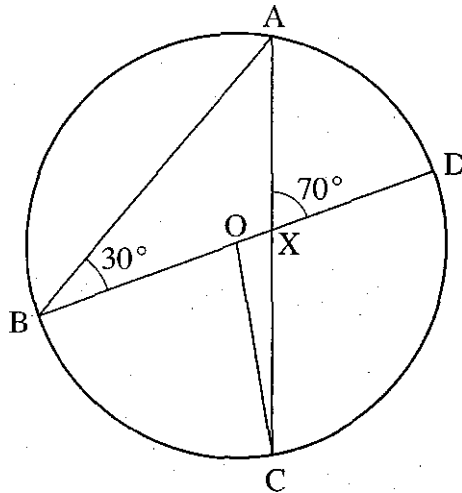
1. The lengths of two similar iron bars were given as 12.5 m and 9.23 m. calculate the maximum possible difference in length between the two bars. (3 marks)

2. The first term of an arithmetic sequence is -7 and the common difference is 3.

(a) List the first six terms of the sequence; (1 mark)

(b) Determine the sum of the first 50 terms of the sequence. (2 marks)

3. In the figure below, BOD is the diameter of the circle centre O. Angle ABD = 30° and angle AXD = 70° .



Determine the size of:

(a) reflex angle BOC; (2 marks)

(b) angle AGO. (1 mark)

4. Three quantities L, M and N are such that L varies directly as M and inversely as the square of N. Given that $L = 2$ when $M = 12$ and $N = 6$, determine the equation connecting the three quantities. (3 marks)

5. The table below shows the frequency distribution of marks scored by students in a test.

Marks	Frequency
1-10	2
11-20	4
21-30	11
31-40	5
41-50	3

Determine the median mark correct to 2 s.f. (4 marks)

6. Determine the amplitude and period of the function $y = 2 \cos (3x - 45)^\circ$. (2 marks)

7. In a transformation, an object with an area of 5 cm^2 is mapped onto an image whose area is 30 cm^2 . Given that the matrix of the transformation is

$$\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix},$$

find the value of x . (3 marks)

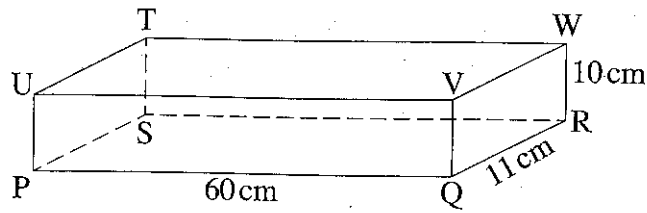
8. Expand $(3 - x)^7$ up to the term containing x^4 . Hence find the approximate value of $(2.8)^7$.

(3 marks)

9. Solve the equation;
 $2 \log 15 - \log x = \log 5 + \log (x - 4)$. (4 marks)

10. The figure below represents a cuboid PQRSTU VW.

PQ = 60cm, QR = 11 cm and RW = 10cm.



Calculate the angle between line PW and plane PQRS, correct to 2 decimal places.

(3 marks)

11.. Solve the simultaneous equations;

$$3.x - y = 9$$

$$x^2 - xy = 4$$

marks)

(4

12. Muga bought a plot of land for Ksh 280 000. After 4 years, the value of the plot was Ksh 495 000. Determine the rate of appreciation, per annum, correct to one decimal place.

(3 marks)

13. The shortest distance between two points A (40°N , 20°W) and B ($\theta^\circ\text{S}$, 20°W) on the surface of the earth is 8008km. Given that the radius of the earth is 6370km, determine the position of B.

(Take $\kappa = \frac{22}{7}$).

(3 marks)

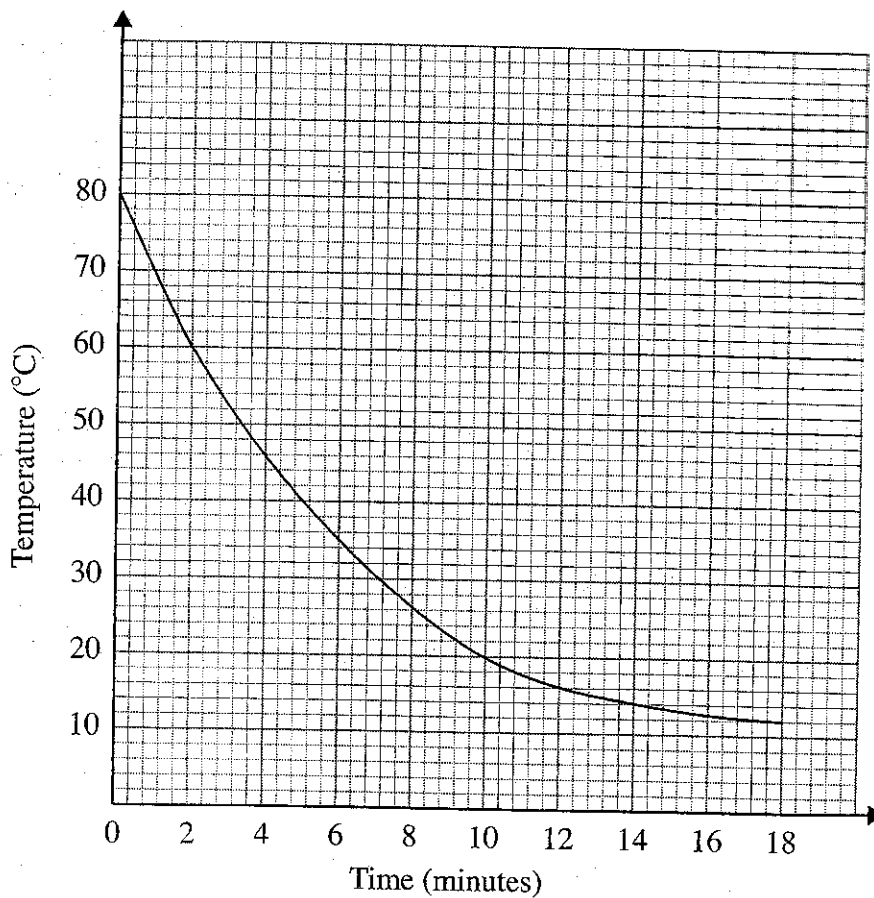
14. Vectors \mathbf{r} and \mathbf{s} are such that $\mathbf{r} = 7\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ and $\mathbf{s} = -\mathbf{i} + \mathbf{j} - \mathbf{k}$. Find $|\mathbf{r} + \mathbf{s}|$.
(3 marks)

15. The gradient of a curve is given by ,

$$\frac{dy}{dx} = x^2 - 4x + 3.$$

The curve passes through the point (1,0) Find the equation of the curve.
(3 marks)

16. The graph below shows the rate of cooling of a liquid with respect to time.



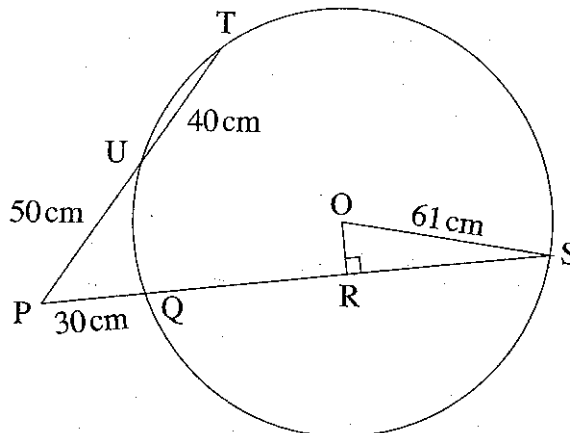
Determine the average rate of cooling of the liquid between the second and the eleventh minutes. (3 marks)

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17. A paint dealer mixes three types of paint A, B and C, in the ratios $A:B = 3:4$ and $B:C = 1:2$. The mixture is to contain 168 litres of C.

- (a) Find the ratio $A:B:C$. (2 marks)
- (b) Find the required number of litres of B. (2 marks)
- (c) The cost per litre of type A is Ksh 160, type B is Ksh 205 and type C is Ksh 100.
- (i) Calculate the cost per litre of the mixture. (2 marks)
- (ii) Find the percentage profit if the selling price of the mixture is Ksh 182 per litre. (2 marks)
- (iii) Find the selling price of a litre of the mixture if the dealer makes a 25% profit. (2 marks)

18. In the figure below OS is the radius of the circle centre O . Chords SQ and TU are extended to meet at P and OR is perpendicular to QS at R . $OS = 61$ cm, $PU = 50$ cm, $UT = 40$ cm and $PQ = 30$ cm.



- (a) Calculate the length of:
- (i) QS ; (2 marks)

(ii) OR. (3 marks)

b) Calculate, correct to 1 decimal place:
(i) the size of angle ROS; (2 marks)

(ii) the length of the minor arc QS. (3 marks)

19. The table below shows income tax rates for a certain year.

Monthly income in Kenya shillings (Ksh)	Tax rate in each shilling
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. In a certain month, of that year, an employee's taxable income in the fifth band was Ksh 2108.

(a) Calculate:
(i) the employee's total taxable income in that month; (2marks)

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

(b) The employee's income included a house allowance of Ksh 15 000 per month. The employee contributed 5% of the basic salary to a co-operative society. Calculate the employees net pay for that month.

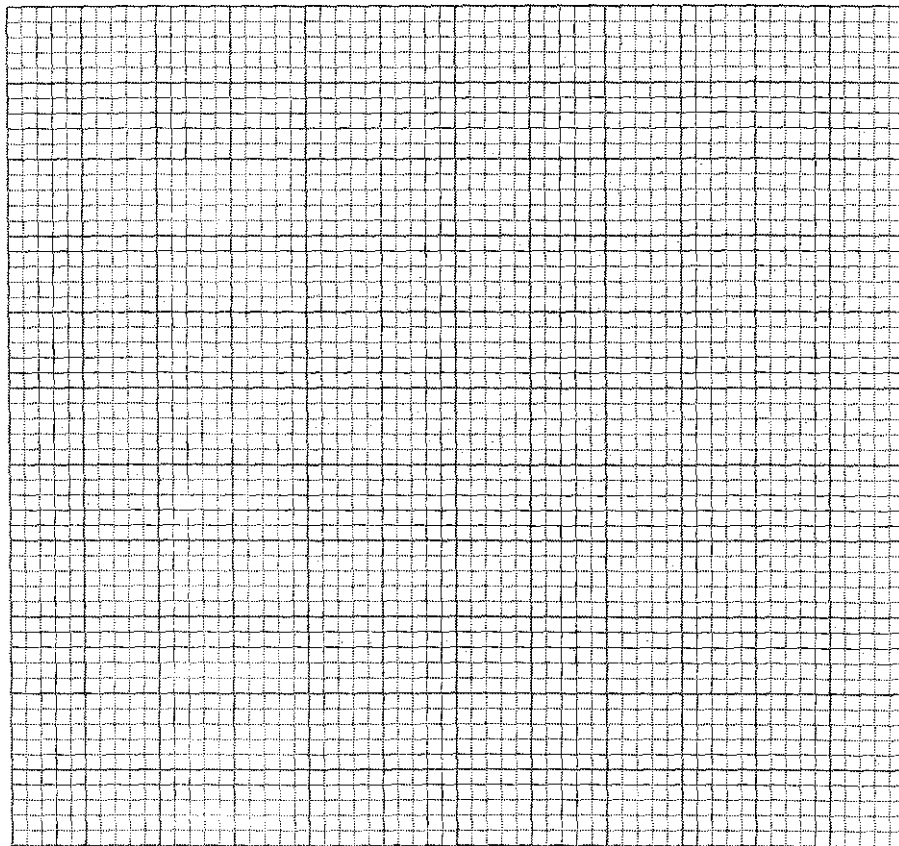
(3 marks)

20. The dimensions of a rectangular floor of a proposed building are such that:
- the length is greater than the width but at most twice the width;
 - the sum of the width and the length is, more than 8 metres but less than 20 metres.

If x represents the width and y the length.

(a) write inequalities to represent the above information.
(4 marks)

(b) (i) Represent the inequalities in part (a) above on the grid provided.
(4 marks)



(ii) Using the integral values of x and y , find the maximum possible area of the floor.

(2 marks)

21. Each morning Gataro does one of the following exercises: Cycling, jogging or weightlifting.

He chooses the exercise to do by rolling a fair die. The faces of the die are numbered

1, 1, 2, 3, 4 and 5.

If the score is 2, 3 or 5, he goes for cycling.

If the score is 1, he goes for jogging.

If the score is 4, he goes for weightlifting.

(a) Find the probability that:

(i) on a given morning, he goes for cycling or weightlifting; (2 marks)

(ii) on two consecutive mornings he goes for jogging. (2 marks)

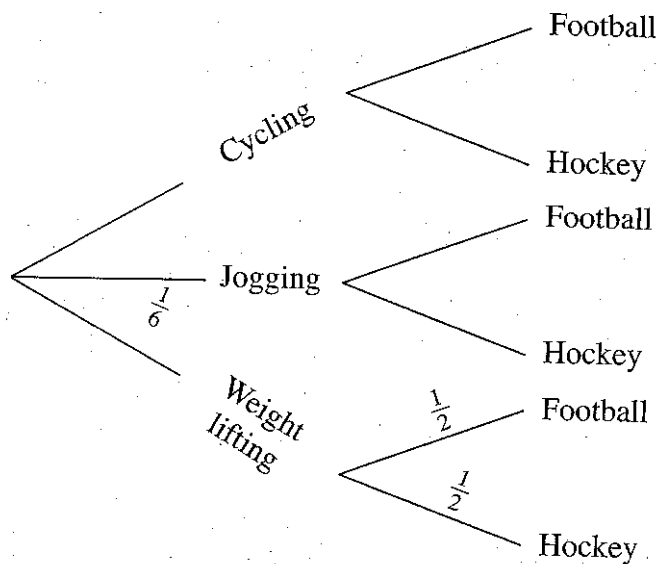
(b) In the afternoon, Gataro plays either football or hockey but never both games. The probability that Gataro plays hockey in the afternoon is:

$\frac{1}{3}$ if he cycled;

$\frac{2}{5}$ if he jogged and

$\frac{1}{2}$ if he did weightlifting in the morning.

Complete the tree diagram below by writing the appropriate probability on each branch. (2 marks)

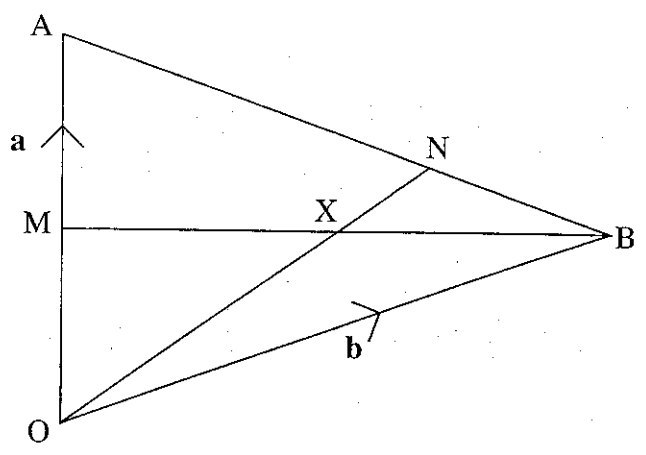


(c) Find the probability that on any given

(i) Gataro plays football; (2 marks)

(ii) Gataro neither jogs nor plays football. (2 marks)

22. In the figure below $OA = a$ and $OB = b$. M is the mid-point of OA and $AN:NB = 2:1$.



(a) Express in terms of a and b :

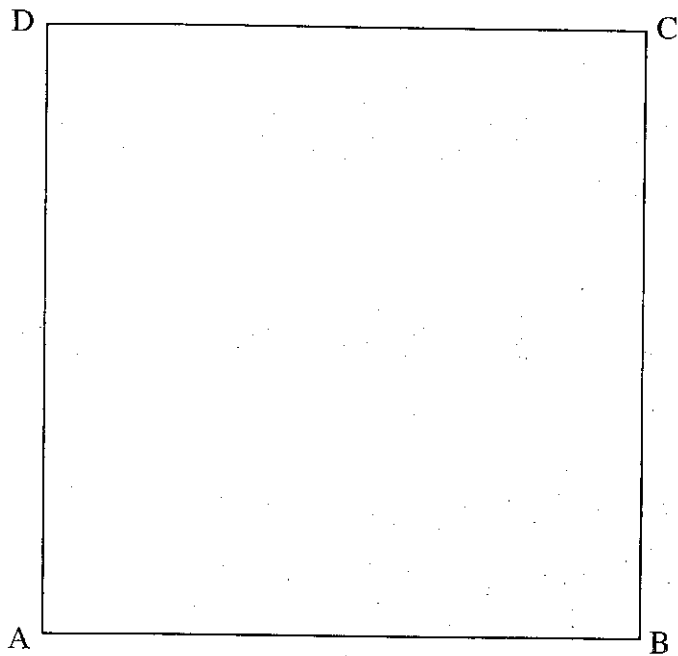
(i) BA ; (1 mark)

(ii) BN ; (1 mark)

(iii) ON . (2 marks)

b) Given that $BX = hBM$ and $OX = kON$ determine the values of h and k . (6 marks)

23. Figure ABCD below is a scale drawing representing a square plot of side 80 metres.



On the drawing, construct:

- (i) the locus of a point P, such that it is equidistant from AD and BC. (2 marks)

- (ii) the locus of a point Q such that $\angle AQB = 60^\circ$ (3 marks)

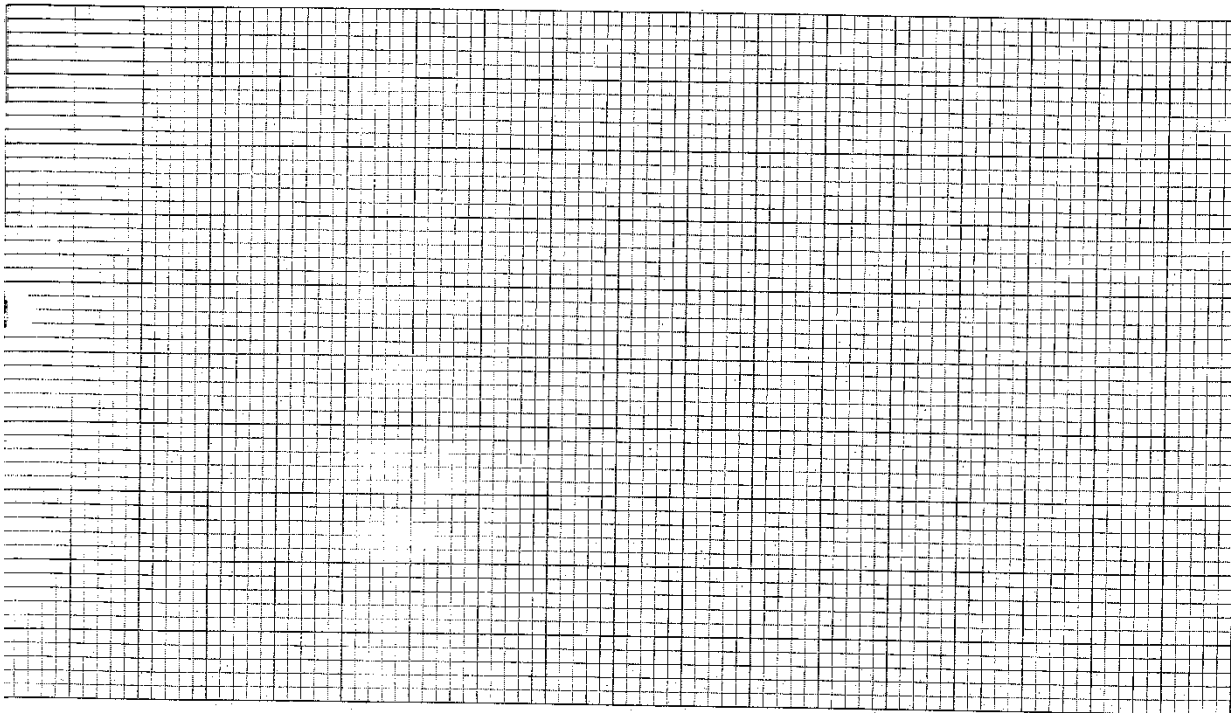
- b)
- (i) Mark on the drawing the point Q_1 the intersection of the locus of Q and line AD. Determine the length of BQ_1 , in metres. (1 mark)

 - (ii) Calculate, correct to the nearest m^2 , the area of the region bounded by the locus of P, the locus of Q and the line BQ_1 (4 marks)

24. In an experiment involving two variables t and r , the following results were obtained.

t	1.0	1.5	2.0	2.5	3.0	3.5
r	1.50	1.45	1.30	1.25	1.05	1.00

(a) On the grid provided, draw the line of best fit for the data. (4 marks)



(b) The variables r and t are connected by the equation $r = at + k$ where a and k are constants. Determine:

(i) the values of a and k ;

(3 marks)

(ii) the equation of the line of best fit.

(1 mark)

(iii) the value of t when $r = 0$.

(2 marks)