5.0 MATHEMATICS ALT A (121)

The 2010 KCSE Mathematics Alternative A was tested in two papers. **Paper 1 (121/1)** and **Paper 2 (121/2)**. The papers are equally weighted with each having two sections; Section 1 (50 marks) short answer questions of not more than four marks each and Section II (50 marks), a choice of eight questions of 10 marks each where candidates answer any five. 2

Paper 1 (121/1) tests mainly Forms 1 and 2 work while Paper 2 (121/2) tests mainly forms 3 and 4 work.

It is hoped that this report will be helpful to teachers in the teaching/learning process as well as in preparing candidates for future examinations.

5.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows the performance of both papers in the last four years.

Table 10: ***Candidates' Performance in Mathematics for the last four years***

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2007	1	**273504**	100	19.55	19.09
	2		100	19.91	20.74
	Overall		**200**	**39.46**	**39.83**
2008	1	**304908**	100	22.76	22.76
	2		100	19.82	19.56
	Overall		**200**	**42.59**	**41.53**
2009	1	**335615**	100	22.37	19.71
	2		100	19.89	18.78
	Overall		**200**	**42.26**	**37.65**
2010	1	**356072**	100	26.21	20.63
	2		100	19.92	20.35
	Overall		**200**	**46.07**	**40.02**

From the table the following observations can be made:

5.1.1 The overall performance in Mathematics Alt A shown a slightly improvement compared to the previous years.

5.1.2 There is a notable improvement in the performance of Paper 1 (121/1) from a mean of 22.27 in the year 2009 to a mean of 26.21 in the year 2010.

5.1.3 Paper 2 (121/2) shown a slight improvement from a mean of 19.89 in the year 2009 to a mean of 19.92 in the year 2010

5.1.4 There has been a significant increase in the candidature over the years.

5.2 INDIVIDUAL QUESTION ANALYSIS

The following is a discussion of the questions in which the candidates performed poorly.

5.2.1 PAPER 1 (121/1)

Question 4

A bus left a petrol station at 9.20 a.m. and travelled at an average speed of 75 km/h to a town N. At 9.40 a.m. a taxi, travelling at an average speed of 95 km/h, left the same petrol station and followed the route of the bus.

Determine the distance, from the petrol station, covered by the taxi at the time it caught up with the bus. (3 marks)

The question tested on relative speed in the topic of linear motion.

Weaknesses

Calculation of the distance covered.

Expected response

Let the distance be d km

$$\frac{d}{75} \text{ or } \frac{d}{95}$$

$$\frac{d}{75} - \frac{d}{95} = \frac{20}{60}$$

$$d = 118.75km$$

Advice to teachers

Give more practical examples in relative motion.

Question 10

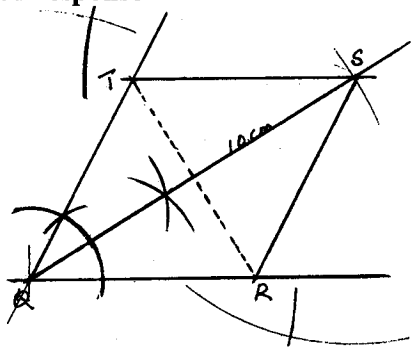
Using a ruler and a pair of compasses only, construct a rhombus QRST in which angle TQR = 60° and QS = 10 cm. (3 marks)

The question tested on basic construction of a rhombus. The candidates were required to have knowledge of the properties of a rhombus.

Weaknesses

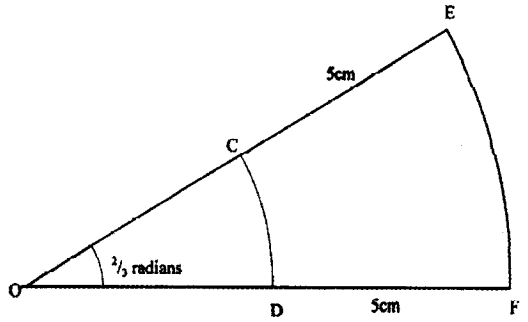
The location of point S. Candidates who did not score in this question took the length of the diagonal as equal to the length of one of the sides.

Expected response



Advice to teachers
Emphasis on construction of basic plane figures is essential. Give guidance on the correct labeling of plane figures.

Question 15
The figure below shows two sectors in which CD and EF are arcs of concentric circles, centre O. Angle COD = radians and CE = DF = 5 cm.



If the perimeter of the shape CDFE is 24 cm, calculate the length of OC. (3 marks)

The question tested on arc length of a circle. Use of the relationship $s = r\theta$ where s is the arc length and θ is the angle at the centre measured in radians was required.

Weaknesses
Use of the radian measure in calculating the arc length. i.e. $s = r\theta$, where θ is in radians

Expected response
Let OC = r

$$\therefore CD = \frac{2}{3}r \quad \text{and} \quad EF = \frac{2}{3}((r+5)$$

$$\frac{2}{3}r + \frac{2}{3}(r+5) + 5 + 5 = 24$$

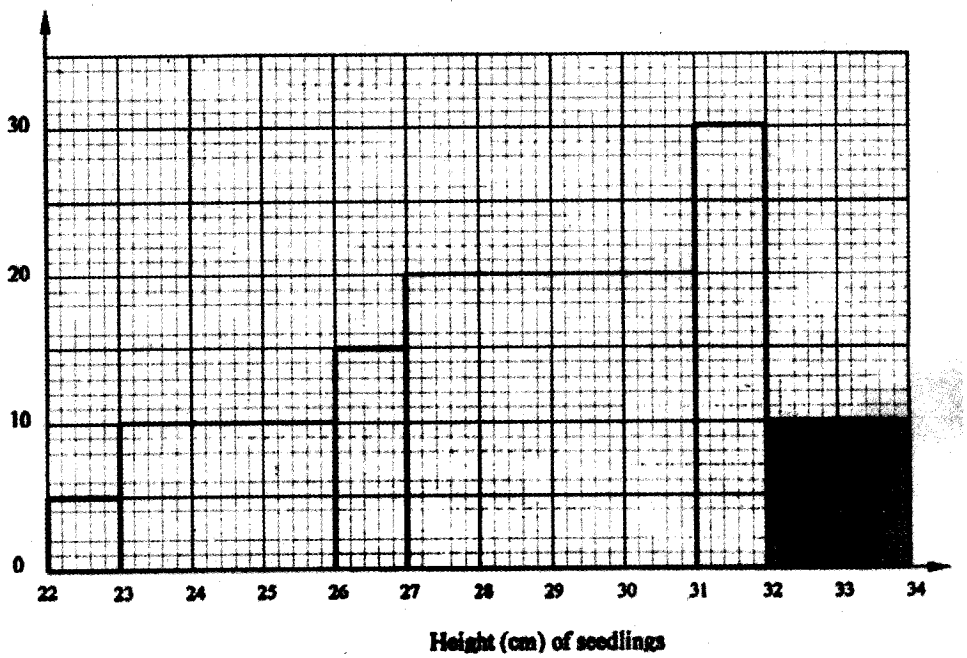
$$\frac{4}{3}r = 10\frac{2}{3}$$

$$r = 8$$

Advice to teachers
Emphasis on the radian measure and on conversion from degrees to radians and vice versa

Question 16

The histogram shown below represents the distribution of heights of seedlings of a certain plant.



The shaded area in the histogram represents 20 seedlings. Calculate the percentage number of seedlings with heights of at least 23 cm but less than 27 cm.

(3 marks)

The question is on representation of data with unequal width using a histogram. The students were required to calculate the frequency density of each class in order to answer the question.

Weaknesses

Most candidates could not interpret the histogram properly and thus unable to answer question.

Expected response

Total No. Of seedlings

$= 5\times1+10\times3+15\times1+20\times4+30\times1+10\times2$

$= 5+30+15+80+30+20$

$= 180$

% height (h) : $23 \le h \angle 27$

$= \left(\frac{30+15}{180}\right)\times100\%$

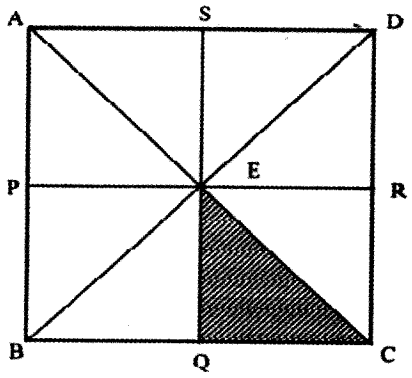
$= 25\%$

Advice to teachers

This is an area which been performed poorly whenever it's tested. Teachers are advised to teach this area thoroughly and give more practice in the area for the concept to be understood clearly.

Question 22

In the figure below, ABCD is a square. Points P, Q, R and S are the midpoints of AB, BC, CD and DA respectively.



(a) Describe fully:

(i) a reflection that maps triangle QCE onto triangle SDE; (1 mark)

(ii) an enlargement that maps triangle QCE onto triangle SAE; (2 marks)

(iii) a rotation that maps triangle QCE onto triangle SED. (3 marks)

(b) The triangle ERC is reflected on the line BD. The image of ERC under the reflection is rotated clockwise through an angle of 90o about P.

Determine the images of R and C:

(i) under the reflection; (2 marks)

(ii) after the two successive transformations. (2 marks)

The question tested on transformations. Candidates were required to know the general properties of transformations, i.e. reflection, rotation and enlargement.

Weaknesses

This question was unpopular with most of the candidates. Some of those who attempted the question had weaknesses in the description of the transformation .

Expected responses

(a) (i) Reflection in the line PR or ER

(ii) Enlargement centre E
Scale factor = -1

(iii) Rotation about point R through 90^0 clockwise

(b) (i) R $\longrightarrow$ S
C $\longrightarrow$ A

(ii) R $\longrightarrow$ Q
C $\longrightarrow$ E

Advice to teachers

The question was unpopular to most of the candidates. Thus there is need for more emphasis on transformations and use of more practical situations other than the ones in the text books only.

5.2.2 PAPER 2 (121/2)

Question10

The points O, A and B have the coordinates (0, 0), (4, 0) and (3, 2) respectively. Under a shear represented by the matrix $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$, triangle OAB maps onto triangle OAB'.

(a) Determine in terms of k, the x coordinate of point B'. (2 marks)

(b) If OAB' is a right angled triangle in which angle $OB'A$ is acute, find two possible values of k. (2 marks)

The question was on matrix transformation. Knowledge of the shear and stretch was important in answering this question

Weaknesses

The question was unfamiliar to both students and teachers especially in part (b). There was wrong interpretation of x and y coordinates with the students. Correct understanding of the shear was also a problem.

Expected responses

(a) $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3+2k \\ 2 \end{pmatrix}$

x ordinate = 3+2k

(b) $3 + 2k = 4 \quad \Rightarrow k = \frac{1}{2}$

$3 + 2k = 0 \Rightarrow k = -\frac{3}{2}$

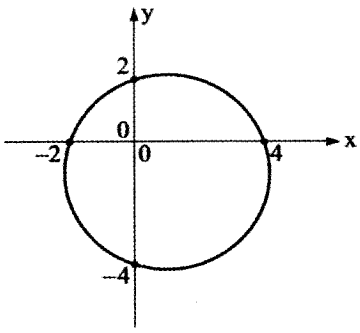
(4 marks)

Advice to teachers

Emphasis on transformation is important and also use of different approaches to teach the topic.

Question16

The circle shown below cuts the x-axis at (–2, 0) and (4, 0). It also cuts y-axis at (0, 2) and (0,–4).



Determine the:

(a) (i) coordinates of the centre; (1 mark)

(ii) radius of the circle. (1 mark)

(b) equation of the circle in the form $x^2 + y^2 + ax + by = c$ where a, b and c are constants.

(2 marks)

The question tested on equation of a circle. The candidates were required to use knowledge of chords in answering the question. Point of intersection of the perpendicular bisector of the chords gives the center on the circle

Weaknesses
Use of the chords to find the coordinates of the centre of the circle was a problem due to failure to relate the perpendicular bisectors of the chords and the centre of the circle.

Expected responses

(a) Coordinates of centre (1, -1)

Radius: $r^2 = 1^2 + 3^3 = 10 \Rightarrow r = \sqrt{10}$

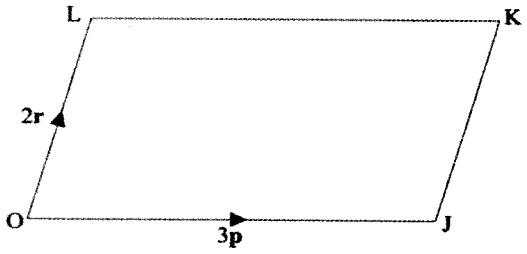
(b) Equation

$$(x-1)^2 + (y+1)^2 = 10$$
$$x^2 - 2x + 1 + y^2 2y + 1 = 10$$
$$x \ + y^2 - 2x + 2y = 8$$

(4 marks)

Advice to teachers
Revise on chord of a circle and their perpendicular bisectors .

Question18
In the figure below OJKL is a parallelogram in which **OJ** = 3**p** and **OL** = 2**r**.



(a) If A is a point on LK such that LA = AK and a point B divides the line JK externally in the ratio 3:1, express **OB** and **AJ** in terms of **p** and **r**. (2 marks)
(b) Line OB intersects AJ at X such that **OX** = m**OB** and **AX** = n**AJ**.
(i) Express **OX** in terms of **p**, **r** and m. (1 mark)
(ii) Express **OX** in terms of **p**, **r** and n. (1 mark)

The question tested on vectors and ration theorem.

Weaknesses

Interpretation of a ratio for external division.

Expected responses
(a) $OB = 3p + 3r$

$AJ = 2p + 2r$

(b) $OX = m(OB) = m(3p + 3r)$

$OX = 2r + p + n(2p - 2r)$

(iii) $m(3p+3r) = 2r-2nr+p+2np$

$3mp+3mr = r(2-2n)+p(1+2n)$

$3mp = (1+2n)p$

$3m = 1+2n$..... (i)

$3mr = r(2-2n)$

$3m = 2-2n$..... (ii)

$1-2n = 2-2n$

$4n = 1 \Rightarrow n = \frac{1}{4}$

Subst. for $n = \frac{1}{4}$ in (i)

$3m = 1+2\times \frac{1}{4}$

$3m = 1\frac{1}{4} \Rightarrow m = \frac{3}{2\times 3} = \frac{1}{2}$

The ratio in which x divides AJ

$AX = nAJ = ¼AJ$

Ratio 1: 3

(10 marks)

Advice to teachers

Emphasize on different situations in external division.

Question 22

The first term of an Arithmetic Progression (A.P.) with six terms is p and its common difference is c. Another A.P. with five terms has also its first term as p and a common difference of d. The last terms of the two Arithmetic Progressions are equal.

(a) Express d in terms of c. (3 marks)

(b) Given that the 4th term of the second A.P. exceeds the 4th term of the first one by $1\frac{1}{2}$, find the values of c and d. (3 marks)

(c) Calculate the value of p if the sum of the terms of the first A.P. is 10 more than the sum of the terms of the second A.P. (4 marks)

The question tested on Arithmetic progression (A.P). Candidates were required to calculate the common differences of the two APs and the first term.

Weaknesses

Relating the terms in the two progressions.

Expected responses

(a)

$$T_6 = p + 5c$$

$$T_5 = p + 4d$$

$$p + 4d = p + 5c$$

$$4d = 5c$$

$$d = \frac{5}{4}c$$

(b)

$$p+3d-(p+3c)=1\frac{1}{2}$$

$$3d-3c=1\frac{1}{2}$$

$$\frac{15}{4}c-3c=1\frac{1}{2}$$

$$\frac{3}{4}c=\frac{3}{2}\Rightarrow c=2$$

$$d=2\frac{1}{2}$$

(c)

$$S_6=\frac{1}{2}n(a+\ell)=\frac{1}{2}n(2p+10)$$

$$=3(2p+10)=6p+30$$

$$S_5=\frac{1}{2}n(2p+10)=2.5(2p+10)=5p+25$$

$$(6p+30)-(5p+25)=10$$

$$p+5=10$$

$$p=5$$

(10 marks)

Advice to teachers

Give more practical examples on the topic of sequence and series.

29.3 MATHEMATICS (121)

29.3.1 Mathematics Alt. A Paper 1 (121/1)

SECTION I (50 marks)

*Answer **all** the question in this section in the spaces provided.*

1 Without using a calculator evaluate,

$$\frac{^{-}2(5+3)-9\div 3+5}{^{-}3\times {}^{-}5+{}^{-}2\times 4}.$$

(3 marks)

2 Kutu withdrew some money from a bank. He spent $\frac{3}{8}$ of the money to pay for Mutua's school fees and $\frac{2}{5}$ to pay for Tatu's school fees. If he remained with Ksh 12 330, calculate the amount of money he paid for Tatu's school fees. (4 marks)

3 A straight line l passes through the point (3, –2) and is perpendicular to a line whose equation is $2y - 4x = 1$.
Find the equation of l in the form $y = mx + c$, where m and c are constants.

(3 marks)

4 A bus left a petrol station at 9.20 a.m. and travelled at an average speed of 75 km/h to a town N. At 9.40 a.m. a taxi, travelling at an average speed of 95 km/h, left the same petrol station and followed the route of the bus.
Determine the distance, from the petrol station, covered by the taxi at the time it caught up with the bus. (3 marks)

5 The sum of three consecutive odd integers is greater than 219. Determine the first three such integers. (3 marks)

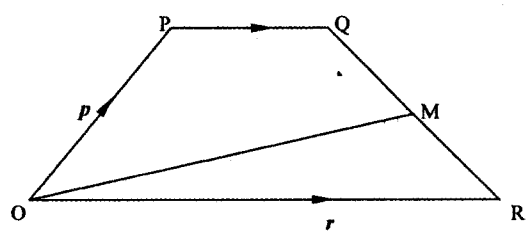
6 A Kenyan company received US Dollars 100 000. The money was converted into Kenya shillings in a bank which buys and sells foreign currencies as follows:

	Buying (in Kenya shillings)	Selling (in Kenya shillings)
1 US Dollar	77.24	77.44
1 Sterling Pound	121.93	122.27

(a) calculate the amount of money, in Kenya shillings, the company received. (2 marks)

(b) The company exchanged the Kenya shillings calculated in (a) above, into sterling pounds to buy a car from Britain. Calculate the cost of the car to the nearest sterling pound. (2 marks)

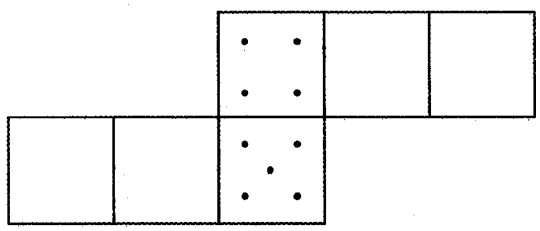
7 In the figure below, OPQR is a trapezium in which PQ is parallel to OR and M is the mid-point of QR. **OP = p**, **OR = r** and **PQ** = $\frac{1}{3}$**OR**.



Find **OM** in terms of **p** and **r**. (3 marks)

8 Without using mathematical tables or a calculator, evaluate $27^{\frac{2}{3}} \times \left(\frac{81}{16}\right)^{-\frac{1}{4}}$. (3 marks)

9 The figure below is a net of a cube with some dots on two faces.



Given that the number of dots on pairs of opposite faces add up to 7, fill in appropriate dots in each of the empty faces. (2 marks)

10 Using a ruler and a pair of compasses only, construct a rhombus QRST in which angle TQR = 60° and QS = 10 cm. (3 marks)

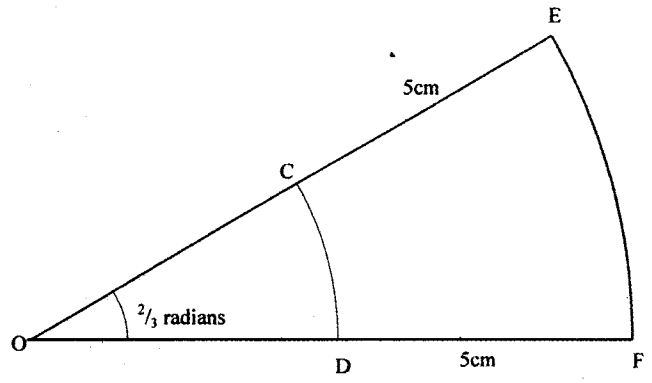
11 A fruit vendor bought 1948 oranges on a Thursday and sold 750 of them on the same day. On Friday, he sold 240 more oranges than on Thursday. On Saturday he bought 560 more oranges. Later that day, he sold all the oranges he had at a price of Ksh 8 each. Calculate the amount of money the vendor obtained from the sales of Saturday. (4 marks)

12 Simplify the expression $\frac{x^2 + x - 4xy - 4y}{(x+1)(4y^2 - xy)}$. (3 marks)

13 Given that 3θ is an acute angle and $\sin 3\theta = \text{Cos } 2\theta°$, find the value of θ. (3 marks)

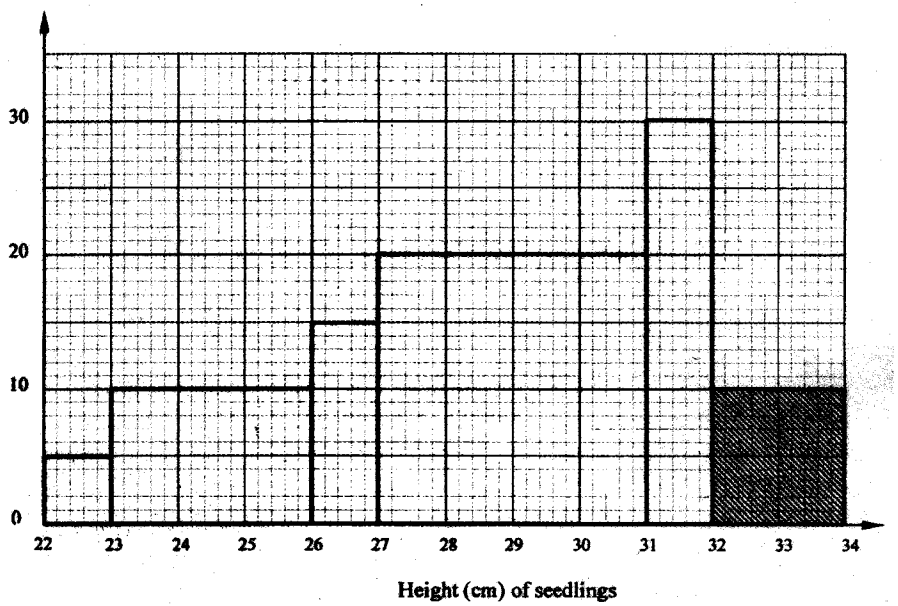
14 A cylindrical solid whose radius and height are equal has a surface area of 154 cm^2. Calculate its diameter, correct to 2 decimal places. (Take $\pi = 3.142$) (3 marks)

15 The figure below shows two sectors in which CD and EF are arcs of concentric circles, centre O. Angle COD = $\frac{2}{3}$ radians and CE = DF = 5 cm.



If the perimeter of the shape CDFE is 24 cm, calculate the length of OC. (3 marks)

16 The histogram shown below represents the distribution of heights of seedlings of a certain plant.



The shaded area in the histogram represents 20 seedlings. Calculate the percentage number of seedlings with heights of at least 23 cm but less than 27 cm. (3 marks)

SECTION II (50 marks)

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

17 A saleswoman is paid a commission of 2% on goods sold worth over Ksh 100 000. She is also paid a monthly salary of Ksh 12 000. In a certain month, she sold 360 handbags at Ksh 500 each.

(a) Calculate the saleswoman's earnings that month. (3 marks)

(b) The following month, the saleswoman's monthly salary was increased by 10%. Her total earnings that month were Ksh 17 600.

Calculate:

(i) the total amount of money received from the sales of handbags that month; (5 marks)

(ii) the number of handbags sold that month. (2 marks)

18 A carpenter constructed a closed wooden box with internal measurements 1.5 metres long, 0.8 metres wide and 0.4 metres high. The wood used in constructing the box was 1.0 cm thick and had a density of 0.6 g/cm^3.

(a) Determine the:

(i) volume, in cm^3, of the wood used in constructing the box; (4 marks)

(ii) mass of the box, in kilograms, correct to 1 decimal place. (2 marks)

(b) Identical cylindrical tins of diameter 10 cm, height 20 cm with a mass of 120 g each were packed in the box.
Calculate the:

(i) maximum number of tins that were packed; (2 marks)

(ii) total mass of the box with the tins. (2 marks)

19 (a) Find A^{-1}, the inverse of matrix $A = \begin{pmatrix} 5 & 6 \\ 7 & 9 \end{pmatrix}$. (2 marks)

(b) Okello bought 5 Physics books and 6 Mathematics books for a total of Ksh 2 440. Ali bought 7 Physics books and 9 Mathematics books for a total of Ksh 3 560.

(i) Form a matrix equation to represent the above information. (1 mark)

(ii) Use matrix method to find the price of a Physics book and that of a Mathematics book. (3 marks)

(c) A school bought 36 Physics books and 50 Mathematics books. A discount of 5% was allowed on each Physics book whereas a discount of 8% was allowed on each Mathematics book.
Calculate the percentage discount on the cost of all the books bought. (4 marks)

20 The boundaries PQ, QR, RS and SP of a ranch are straight lines such that:
Q is 16 km on a bearing of 040° from P; R is directly south of Q and east of P and S is 12 km on a bearing of 120° from R.

(a) Using a scale of 1cm to represent 2 km, show the above information in a scale drawing. (3 marks)

(b) From the scale drawing determine:

(i) the distance, in kilometres, of P from S; (2 marks)

(ii) the bearing of P from S. (2 marks)

(c) Calculate the area of the ranch PQRS in square kilometres. (3 marks)

21 Motorbike A travels at 10 km/h faster than motorbike B whose speed is x km/h. Motorbike A takes $1\frac{1}{2}$ hours less than motorbike B to cover a 180 km journey.

(a) Write an expression in terms of x for the time taken to cover the 180 km journey by:

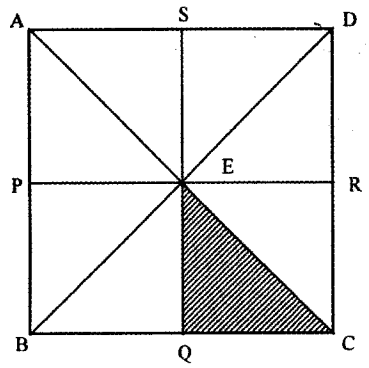
(i) motorbike A; (1 mark)

(ii) motorbike B. (1 mark)

(b) Use the expressions in (a) above to determine the speed, in km/h, of motorbike A. (6 marks)

(c) For a journey of 48 km, motorbike B starts 10 minutes ahead of motorbike A. Calculate, in minutes, the difference in the time of their arrival at the destination. (2 marks)

22 In the figure below, ABCD is a square. Points P, Q, R and S are the midpoints of AB, BC, CD and DA respectively.



(a) Describe fully:

(i) a reflection that maps triangle QCE onto triangle SDE; (1 mark)

(ii) an enlargement that maps triangle QCE onto triangle SAE; (2 marks)

(iii) a rotation that maps triangle QCE onto triangle SED. (3 marks)

(b) The triangle ERC is reflected on the line BD. The image of ERC under the reflection is rotated clockwise through an angle of 90° about P.
Determine the the images of R and C:

(i) under the reflection; (2 marks)

(ii) after the two successive transformations.

(2 marks)

23 The frequency distribution table below represents the number of kilograms of meat sold in a butchery.

Mass in Kg	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35
Frequency	2	3	6	8	3	2	1

(a) State the modal frequency (1 mark)

(b) Calculate the mean mass. (5 marks)

(c) Calculate the median mass. (4 marks)

24 A rectangular box open at the top has a square base. The internal side of the base is x cm long and the total internal surface area of the box is 432 cm^2.

(a) Express in terms of x:

(i) the internal height h, of the box; (3 marks)

(ii) the internal volume V, of the box. (1 mark)

(b) Find:

(i) the value of x for which the volume V is maximum; (4 marks)

(ii) the maximum internal volume of the box. (2 marks)

29.3.2 Mathematics Alt. A Paper 2 (121/2)

SECTION I (50 marks)

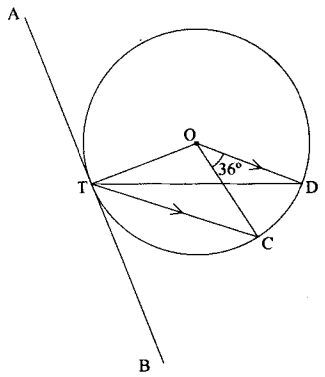
*Answer **all** the questions in this section in the spaces provided.*

1 The length and width of a rectangle measured to the nearest millimetre are 7.5 cm and 5.2 cm respectively.

Find, to four significant figures, the percentage error in the area of the rectangle. (3 marks)

2 Simplify $\frac{4}{\sqrt{5}+\sqrt{2}} - \frac{3}{\sqrt{5}-\sqrt{2}}$. (3 marks)

3 In the figure below, O is the centre of the circle which passes through the points T, C and D. Line TC is parallel to OD and line ATB is a tangent to the circle at T. Angle DOC = 36°.



Calculate the size of angle CTB. (3 marks)

4 A tea dealer mixes two brands of tea, x and y, to obtain 35 kg of the mixture worth Ksh 62 per kg. If brand x is valued at Ksh 68 per kg and brand y at Ksh 53 per kg, calculate the ratio, in its simplest form, in which the brands x and y are mixed. (2 marks)

5 The length of a flower garden is 2 m less than twice its width. The area of the garden is 60 m^2. Calculate its length. (3 marks)

6 Five people can build 3 huts in 21 days. Find the number of people, working at the same rate that will build 6 similar huts in 15 days. (2 marks)

7 When Ksh 40 000 was invested in a certain bank for 5 years it earned a simple interest of Ksh 3 800.

Find the amount that must have been invested in the same bank at the same rate for $7\frac{1}{2}$ years to earn a simple interest of Ksh 3 420. (3 marks)

8 The heights, in centimetres, of 100 tree seedlings are shown in the table below.

Height (cm)	10–19	20–29	30–39	40–49	50–59	60–69
Number of Seedlings	9	16	19	26	20	10

Find the quartile deviation of the heights. (4 marks)

9 A bag contains 2 white balls and 3 black balls. A second bag contains 3 white balls and 2 black balls. The balls are identical except for the colours.

Two balls are drawn at random, one after the other from the first bag and placed in the second bag. Calculate the probability that the 2 balls are both white. (2 marks)

10 The points O, A and B have the coordinates (0,0), (4,0) and (3,2) respectively. Under a shear represented by the matrix $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$, triangle OAB maps onto triangle OAB′.

(a) Determine in terms of k, the x coordinate of point B′. (2 marks)

(b) If OAB′ is a right angled triangle in which angle OB′A is acute, find two possible values of k. (2 marks)

11 A particle starts from O and moves in a straight line so that its velocity V ms^{-1} after time t seconds is given by $V = 3t - t^2$. The distance of the particle from O at time t seconds is s metres.

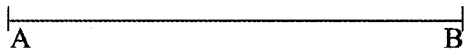
(a) Express s in terms of t and c where c is a constant. (1 mark)

(b) Calculate the time taken before the particle returns to O. (3 marks)

12 (a) Expand and simplify $(2 - x)^5$. (2 marks)

(b) Use the first 4 terms of the expansion in part (a) above to find the approximate value of $(1.8)^5$ to 2 decimal places. (2 marks)

13 (a) Using line AB given below, construct the locus of a point P such that $\angle APB = 90°$. (1 mark)



(b) On the same diagram locate **two** possible positions of point C such that point C is on the locus of P and is equidistant from A and B. (2 marks)

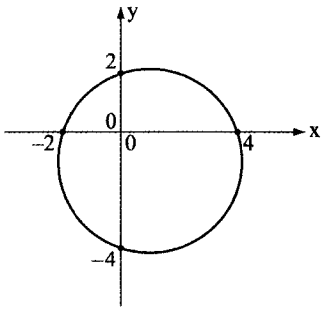
14 Make x the subject of the equation:

$$3y = y + \frac{p}{q + \frac{1}{x}}$$ (3 marks)

15 Find the value of x given that

$\log(15 - 5x) - 1 = \log(3x - 2)$ (3 marks)

16 The circle shown below cuts the x-axis at $(-2,0)$ and $(4,0)$. It also cuts y-axis at $(0,2)$ and $(0,-4)$.



Determine the:

(a) (i) coordinates of the centre; (1 mark)

(ii) radius of the circle. (1 mark)

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

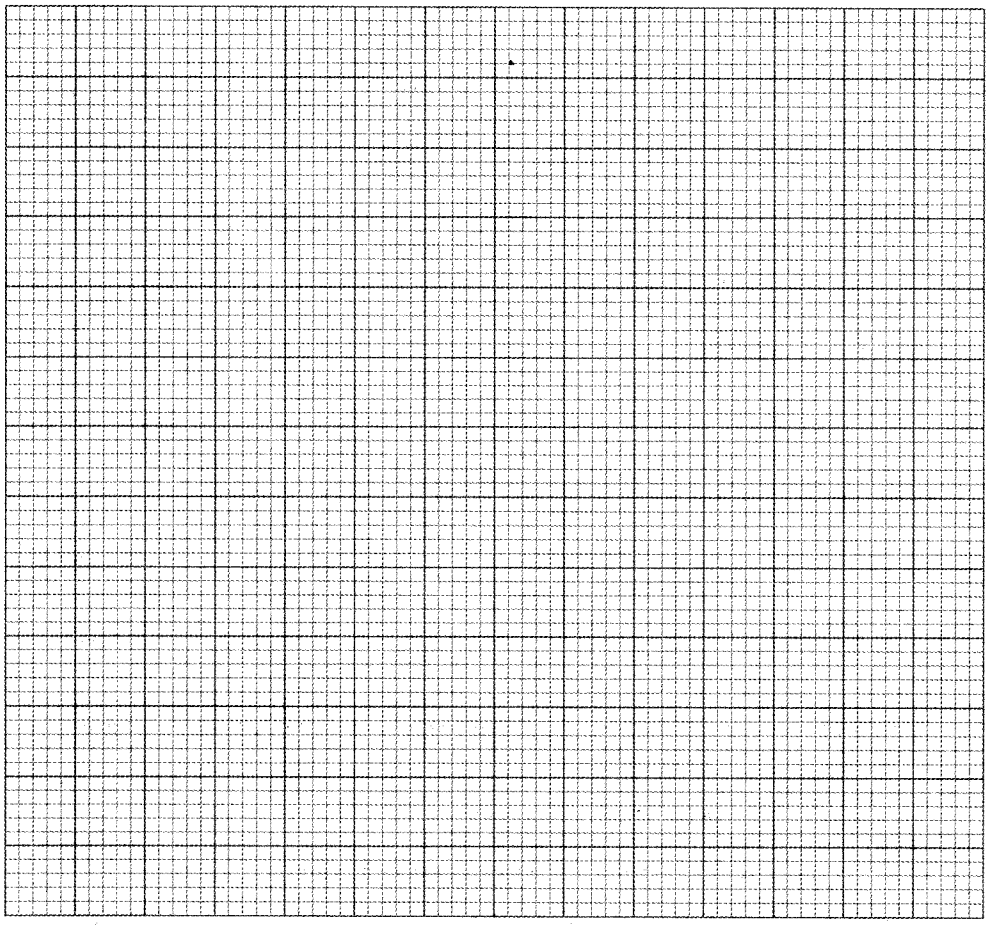
SECTION II (50 marks)

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

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

x^o	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
Cos x^o	1.00	0.94	0.77	0.50		–0.17		–0.77		–1.00
Sin x^o – Cos x^o	–1.00	–0.60		0.37	0.81		1.37		1.28	1.00

(b) On the grid provided and using the same axes draw the graphs of $y = \cos x^o$ and $y = \sin x^o - \cos x^o$ for $0^o \leq x \leq 180^o$. Use the scale; 1 cm for 20° on the x-axis and 4 cm for 1 unit on the y-axis. (5 marks)



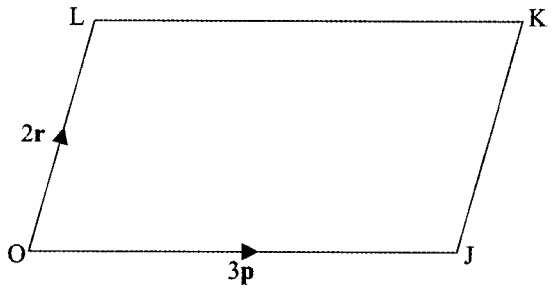
(c) Using the graph in part (b):

(i) solve the equation $\sin x^{o} - \cos x^{o} = 1.2$; (1 mark)

(ii) solve the equation $\cos x^{o} = \frac{1}{2}\sin x^{o}$; (1 mark)

(iii) determine the value of $\cos x^{o}$ in part (c) (ii) above. (1 mark)

18 In the figure below OJKL is a parallelogram in which **OJ** = 3**p** and **OL** = 2**r**.



(a) If A is a point on LK such that LA = $\frac{1}{2}$AK and a point B divides the line JK externally in the ratio 3:1, express **OB** and **AJ** in terms of **p** and **r**. (2 marks)

(b) Line OB intersects AJ at X such that **OX** = m**OB** and **AX** = n**AJ**.

(i) Express **OX** in terms of **p**, **r** and m. (1 mark)

(ii) Express **OX** in terms of **p**, **r** and n. (1 mark)

(iii) Determine the values of m and n and hence the ratio in which point X divides line AJ. (6 marks)

19 The positions of three ports A, B and C are (34°N, 16°W), (34°N, 24°E) and (26°S, 16°W) respectively.

(a) Find the distance in nautical miles between:

(i) Ports A and B to the nearest nautical miles; (3 marks)

(ii) Ports A and C. (2 marks)

(b) A ship left Port A on Monday at 1330 h and sailed to Port B at 40 knots.

Calculate:

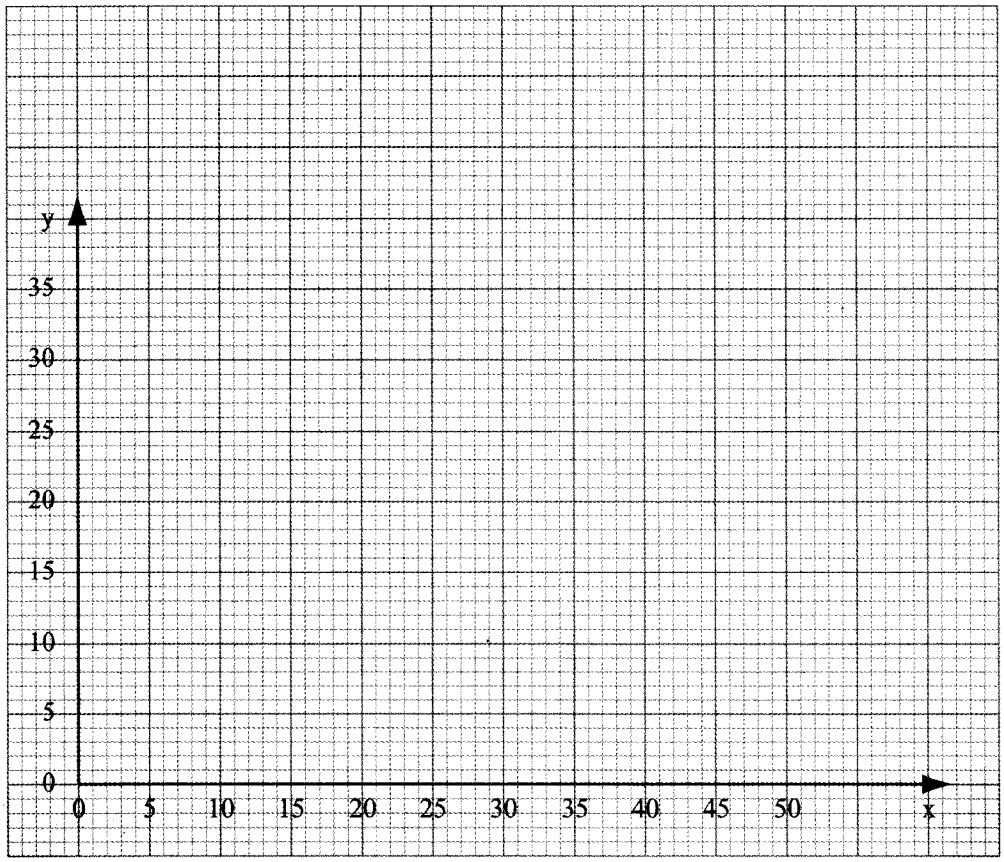
(i) the local time at Port B when the ship left Port A; (2 marks)

(ii) the day and the time the ship arrived at port B. (3 marks)

20 A carpenter takes 4 hours to make a stool and 6 hours to make a chair. It takes the carpenter and at least 144 hours to make x stools and y chairs. The labour cost of making a stool is Ksh 100 and that of a chair is Ksh 200. The total labour cost should not exceed Ksh 4 800. The carpenter must make at least 16 stools and more than 10 chairs.

(a) Write down inequalities to represent the above information. (3 marks)

(b) Draw the inequalities in (a) above on the grid provided. (4 marks)



(c) The carpenter makes a profit of Ksh 40 on a stool and Ksh 100 on a chair.

Use the graph to determine the maximum profit the carpenter can make. (3 marks)

21 A hall can accommodate 600 chairs arranged in rows. Each row has the same number of chairs. The chairs are rearranged such that the number of rows are increased by 5 but the number of chairs per row is decreased by 6.

(a) Find the original number of rows of chairs in the hall. (6 marks)

(b) After the re-arrangement 450 people were seated in the hall leaving the same number of empty chairs in each row. Calculate the number of empty chairs per row. (4 marks)

22 The first term of an Arithmetic Progression (A.P.) with six terms is p and its common difference is c. Another A.P. with five terms has also its first term as p and a common difference of d. The last terms of the two Arithmetic Progressions are equal.

(a) Express d in terms of c. (3 marks)

(b) Given that the 4th term of the second A.P. exceeds the 4th term of the first one by $1\frac{1}{2}$, find the values of c and d. (3 marks)

(c) Calculate the value of p if the sum of the terms of the first A.P. is 10 more than the sum of the terms of the second A.P. (4 marks)

23 In a uniformly accelerated motion the distance, s metres, travelled in time t seconds varies partly as the time and partly as the square of the time. When the time is 2 seconds, the distance travelled is 80 metres and when the time is 3 seconds, the distance travelled is 135 metres.

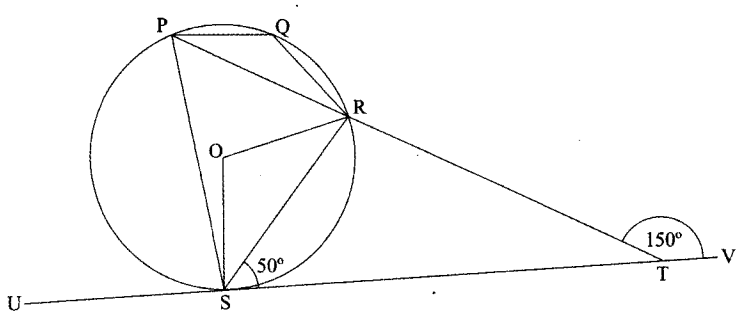
(a) Express s in terms of t. (5 marks)

(b) Find:

(i) the distance travelled in 5 seconds; (2 marks)

(ii) the time taken to travel a distance of 560 metres. (3 marks)

24 In the figure below, P, Q, R and S are points on the circle centre O. PRT and USTV are straight lines. Line USTV is a tangent to the circle at S, $\angle RST = 50^\circ$ and $\angle RTV = 150^\circ$.



(a) Calculate the size of:

(i) $\angle ORS$; (2 marks)

(ii) $\angle USP$; (1 mark)

(iii) $\angle PQR$. (2 marks)

(b) Given that RT = 7 cm and ST = 9 cm, calculate to 3 significant figures:

(i) the length of line PR; (2 marks)

(ii) the radius of the circle. (3 marks)

30.3 MATHEMATICS (121)

30.3.1 Mathematics (121/1)

1. $$\frac{-2(5+3-9\div 3+5}{-3\times {}^{-}5+({}^{-}2)\times 4}=\frac{-14}{7}=-2$$

(3marks)

2. Total fraction $\frac{3}{8}+\frac{2}{5}=\frac{31}{40}$

Remaining fraction $=\frac{9}{40}$

Original amount $=$ Sh. $12{,}330\times\frac{40}{9}$

$=$ Sh. 54,800

Tatu's fees $=$ Sh. $\frac{2}{5}\times 54800$

$=$ Sh. 21920

(4 marks)

3. Gradient $=-\frac{1}{2}$

$$\frac{y+2}{x-3}=-\frac{1}{2}$$

$$y=-\frac{1}{2}x-\frac{1}{2}$$

(3 marks)

4. Let the distance be d km

$$\frac{d}{75}\,or\,\frac{d}{95}$$

$$\frac{d}{75}-\frac{d}{95}=\frac{20}{60}$$

$$d=118.75km$$

(3 marks)

5. Let odd integers be

$x,\ (x+2),\ (x+2+2)$

$x+(x+2)+(x+2+2)>219$

$3x>213$

$x>71$

The numbers are 73, 75, 77

(3 marks)

6. (a) Sh. 77.24 x 100,000

= sh. 7 724 000

(b) $\dfrac{Sh..77.24 \times 100000}{122.27}$

= Sh. 63 172

(4 marks)

7. $RQ = -r + P + \frac{1}{3}r$

$= P - \frac{2}{3}r$

$OM = r + \frac{1}{2}(P - \frac{2}{3}r)$

$= \frac{2}{3}r + \frac{1}{2}P$

(3 marks)

8. $27^{\frac{2}{3}} \times \left(\frac{81}{16}\right)^{-\frac{1}{4}} = (3^3)^{\frac{2}{3}} \times \left(\frac{3^4}{2^4}\right)^{-\frac{1}{4}}$

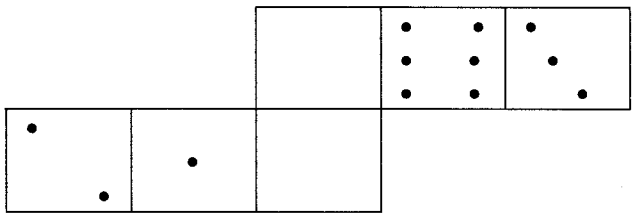
$= 3^2 \times \left(\frac{3}{2}\right)^{-1}$

$= 3^2 \times \frac{2}{3}$

$= 6$

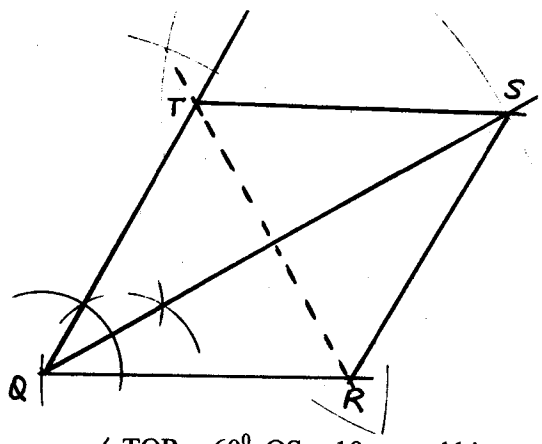
(3 marks)

9.



(2 mark

10.



$\angle$ TQR = 60^0, QS = 10cm and bisects $\angle$ TQR

Mediator of QS drawn or $\angle$ RSQ = $\angle$ QST = $\angle$ RQS

Rhombus completed

(3 marks)

11. No. Of oranges for Friday

1948 – (650 + 750 + 240)

= 208

No. Of oranges for Saturday

208 + 560

= 768

Amount = Sh. 8 x 768

= Sh. 6,144

(4 marks)

12. $$\frac{x^2 + x - 4xy - 4y}{(x+1)(4y^2 - xy)} = \frac{x(x+1) = 4y(x+1)}{(x+1)(y)(4y - x)}$$

$$= \frac{(x-4y)(x+1)}{(x+1)(-y)(x-4y)}$$

$$= -\frac{1}{y}$$

(3 marks)

13. Sin 3θ = cos 2θ

Sin 3θ = Sin (90^0 - 2θ)

$3\theta = 90^0 - 2\theta$

$5\theta = 90^0$

$\theta = 18^0$

(3 marks)

14. $2\pi r^2 + 2\pi rh = 154$

$r = h$

$2\pi r^2 + 2\pi r^2 = 154$

$2\pi r^2 = 154$

$r = \sqrt{\dfrac{154}{4x3.142}}$

$= 3.500$

$d = 2r = 3.500x2$

$= 7.00$

(3 marks)

15. Let OC = r

$\therefore CD = \frac{2}{3}r$ and $EF = \frac{2}{3}((r+5)$

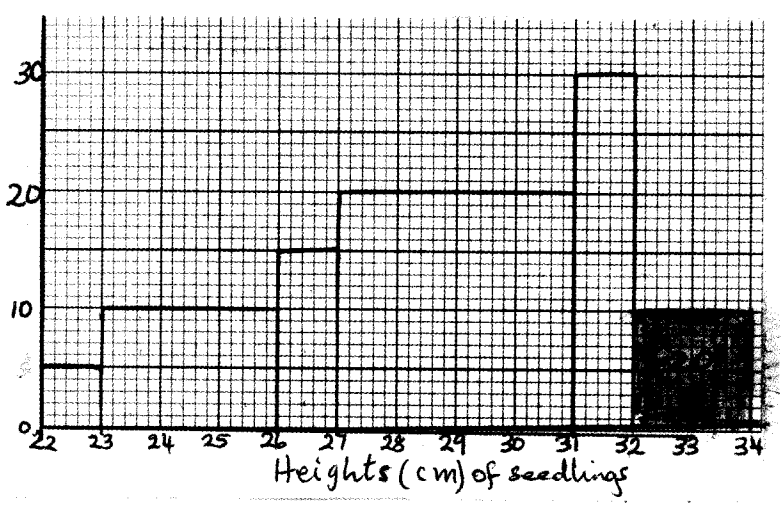
$\frac{2}{3}r + \frac{2}{3}(r+5) + 5 + 5 = 24$

$\frac{4}{3}r = 10\frac{2}{3}$

$r = 8$

(3 marks

16.



Total No. of seedlings

$= 5\times1 + 10\times3 + 15\times1 + 20\times4 + 30\times1 + 10\times2$

$= 5 + 30 + 15 + 80 + 30 + 20$

$= 180$

% height $h: 23 \le h \angle 27$

$= \left(\dfrac{30+15}{180}\right)\times100\% = 25\%$ (3 marks)

SECTION II

17. (a) Total sales = Sh. 360 × 500
= Sh. 180,000

Commission = Sh $(180000 - 100000) \times \frac{2}{100}$ = Sh 1600

Total earnings = Sh $(12000 + 1600)$ = Sh 13600

(b) (i) New salary = Sh $12000 + 12000 \times \frac{10}{100}$

Or Sh $12000 \times \frac{110}{100}$ = Sh 13200

Commission paid= sh $(17600 - 13200)$ = Sh 4400

Commission is paid on Sh $4400 \times \frac{100}{2}$ = Sh 220000

Total sales = Sh 220000 + 100000 =320000

No. of bags sold = $\frac{320000}{500}$ = 640

(10 marks)

18. (a) (i) Int. vol. of the box $= 150 \times 80 \times 40 cm^3$
$= 480000 cm^3$

Ext. Vol. $= 152 \times 82 \times 42 cm^3$
$= 523488 cm^3$

Vol. of wood $= 523488 - 480000$
$= 43488 cm^3$

(ii) Mass of box $= \frac{43488 \times 0.6}{1000}$

$= 26.0928$

$= 26.1$

(b) (i) No. of tins $= \frac{150}{10} + \frac{80}{10} + \frac{40}{20} = 240$

(ii) Total mass $= 26.1 + \frac{240 \times 120}{1000} = 54.9 kg$

(10 marks)

19. (a) Det $\left|45-42\right| = 3$

Inverse $A^{-1} = \frac{1}{3}\begin{pmatrix} 9 & {}^{-}6 \\ {}^{-}7 & 5 \end{pmatrix}$

(b) (i)

$$\begin{pmatrix} 5 & 6 \\ 7 & 9 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 & 4 & 4 & 0 \\ 3 & 5 & 6 & 0 \end{pmatrix}$$

(ii)

$$\begin{pmatrix} 5 & 6 \\ 7 & 9 \end{pmatrix}\begin{pmatrix} 3 & {}^{-}2 \\ \frac{{}^{-}7}{3} & \frac{5}{3} \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & -2 \\ \frac{{}^{-}7}{3} & \frac{5}{3} \end{pmatrix}\begin{pmatrix} 2 & 4 & 4 & 6 \\ 3 & 5 & 6 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3\times 2440 - 2\times 3560 \\ \frac{{}^{-}7}{3}\times 2440 + \frac{5}{3}\times 3560 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 200 \\ 240 \end{pmatrix}$$

(c) Total cost of books $= 36\times 200 + 50\times 240 = 19200$

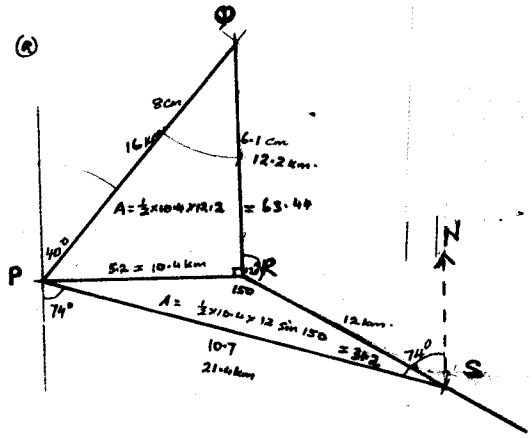
Total cost with discount

$$= \frac{36\times 200\times 95}{100} + \frac{50\times 200\times 92}{100} = 17880$$

% discount $= \left(\frac{19200-17880}{19200}\right)\times 100 = 6.875\%$

(10 marks)

20.



(b) (i) Distance of P from S = 10.7 cm
= 21.4 km

(ii) Angle PSN = 74^0
Bearing of P from S = 286^0

(c) Area of $\Delta PQR = \frac{1}{2} \times 10.4 \times 12.2 = 63.44 km^2$

Area of $\Delta PRS = \frac{1}{2} \times 10.4 \times 12 \sin 150 = 31.2 km^2$

Area of ranch PORS = 63.44 + 31.2 = 96.64 km^2

(10 marks)

21. (a) (i) A takes $\frac{180}{x+10}$

(ii) B takes $\frac{180}{x}$

(b) $\frac{180}{x} - \frac{180}{x+10} = \frac{3}{2}$

$$180(x+10) - 180x = \frac{3}{2}x(x+10)$$
$$360(x+10) - 360x = 3x(x+10)$$
$$360x + 3600 - 360x = 3x^2 + 30x$$
$$x^2 + 10x - 1200 = 0$$
$$(x-30)(x+40) = 0$$
$$x = 30 \text{ or } x = -40$$

Speed of A = 30+10=40

(c) Time taken by A = $\frac{48}{40} \times 60 = 72\,\text{min}$

Time taken by B = $\frac{48}{30} \times 60 = 96\,\text{min}$

Time for B = 96 -10 = 86 min

Difference in time = 86 – 72 min
= 14 min

(10 marks)

22. (a) (i) Reflection in the line PR or ER

(ii) Enlargement centre E
Scale factor = -1

(iii) Rotation about point R through 90^0 clockwise

(b) (i) R → S
C → A

(ii) R → Q
C → E

(10 marks)

23.

No. of Kgs of meat	Frequency (f)	Mid-points (x)	Fx	CF
1 – 5	2	3	6	2
6 – 10	3	8	24	5
11 – 15	6	13	78	11
16 – 20	8	18	144	19
21 – 25	3	23	69	22
26 – 30	2	28	56	24
31 – 35	1	33	33	25
	$\sum f = 25$		$\sum fx = 410$	

(a) Modal frequency = 8

(b) Mean = $\frac{410}{25} = 16.4$

(c) CF: 2, 5, 11,19, 22, 24, 25

Median = $15.5 + \frac{2}{8} \times 5 = 16.75$

(10 marks)

24. (a) (i) Area of base x^2

Or Area of sides = $4xh$

$$x^2 + 4xh = 432$$

$$h = \frac{432 - x^2}{4x}$$

(ii) Vol. $= x^2 h$

$$= x^2\left(\frac{432 - x^2}{4x}\right)$$

(ii) Vol $= 108x - \frac{1}{4}x^3$

$$\frac{dv}{dx} = 108 = \frac{3}{4}x^2$$

$$108 - \frac{3}{4}x^2 = 0$$

$$x = 12$$

(iii) Vol. $= 108x - \frac{1}{4}x^3$

$$= 108 \times 12 - \frac{1}{4} \times 12^3$$

$$= 864cm^3$$

(1 marks)

30.3.2 Mathematics Paper 2 (121/2)

1. $$\frac{(7.55 \times 5.25) - (7.45 \times 5.15)}{2 \times 7.5 \times 5.2} \times 100 = 1.628$$

(3 marks)

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

$$= \frac{4(\sqrt{5} - \sqrt{2}) - 3\sqrt{5} + \sqrt{2}}{(\sqrt{5} + \sqrt{2})(\sqrt{5} - \sqrt{2})}$$

$$= \frac{4\sqrt{5} - 4\sqrt{2} - 3\sqrt{5} - 3\sqrt{2}}{3}$$

$$= \frac{\sqrt{5} - 7\sqrt{2}}{3}$$

(3 marks)

3. $\angle OCT = 36^0$ (Alt. $\angle s$ equal)
$\angle OTC = 36^0$ (Base $\angle s$ of isosceles Δ)
$\angle CTB = 90^0 - 36^0 = 54$

(3 marks)

4. Let ratio x to y be a:b

$$\frac{68a + 53b}{a + b} = 62$$

$\Rightarrow 6a = 9b$

$\therefore a : b = 9 : 6$

$= 3 : 2$

(2 marks)

5. Let the width be x m

Length = $2x - 2$

Area = $(2x - 2)x = 60$

$x^2 - x - 30 = 0$

$(x - 6)(x + 5) = 0$

$x = 6$

$\therefore$ length = 2 x 6 – 2 = 10 cm

(3 marks)

6. One person can build $\frac{1}{5}x3$ huts in 21 days.

10 people can build 6 huts in 21 days.
x people can build 6 huts in 15 days

$$x = \frac{21}{15}x10 = 14 \text{ people}$$

(2 marks)

7. R = $\frac{3800 \times 100}{40000 \times 5} = 1.9\%$

A = $\frac{3940 \times 100}{7.5 \times 1.9} = 24000$

(3 marks)

8. Upper quartile = $49.5 \times \frac{5}{20} \times 10 = 52$

Lower quartile= $19.5 + \frac{16}{10} \times 10 = 29.5$

Quartile deviation = $\frac{52 - 29.5}{2} = 11.25$

(4 marks)

9. $P(ww)=\frac{2}{5}\times\frac{1}{4}=\frac{1}{10}$

$P(bb)=\frac{2}{7}\times\frac{1}{6}=\frac{1}{21}$

(2 marks)

10. (a) $\begin{pmatrix}1 & k\\0 & 1\end{pmatrix}\begin{pmatrix}3\\2\end{pmatrix}=\begin{pmatrix}3+2k\\2\end{pmatrix}$

x ordinate = 3+2k

(b) $3+2k=4 \quad \Rightarrow k=\frac{1}{2}$

Or $\quad 3+2k=0 \Rightarrow k=\frac{-3}{2}$

(4 marks)

11. (a) $S=\frac{3}{2}t^2-\frac{1}{3}t^3+C$

(b) When t = 0, s = 0

$\therefore$ C = 0

$S=\frac{3}{2}t^2-\frac{1}{3}t^3=0$

$t^2\left(\frac{3}{2}-\frac{1}{3}t\right)=0$

$t=0 \quad Or \quad t=4.5$

$t=4.5$

(4 marks)

12. (a) $(2-x)^5=2^5-5(2)^4x+10(2)^3x^2$

$-10(2)^2x^3+5(2)x^4-x^5$

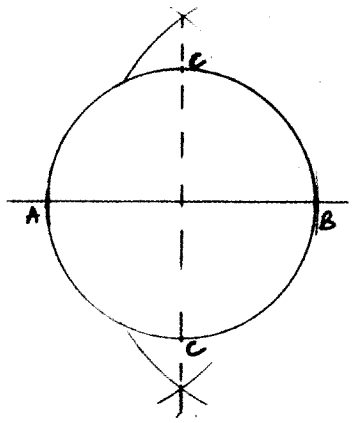
$=32-80x+80x^2-40x^3+10x^4-x^5$

(b) $(2-o.2)^5=32-80(0.2)+80(0.2)^2-40(0.2)^3$

$=32-16+3.2-0.32=18.88$

(4 marks)

13.



(a) Locus of P

(b) ⊥ bisector of AB

Positions of CV indicated

(3 marks)

14. $3y - y = \dfrac{p}{q + \dfrac{1}{x}}$

$2y\left(q + \dfrac{1}{x}\right) = p$

$q + \dfrac{1}{x} = \dfrac{p}{2y}$

$\dfrac{1}{x} = \dfrac{p}{2y} - q$

$x = \dfrac{2y}{p - 2yq}$

(3 marks

15. $\log\left(\dfrac{15 - 5x}{10}\right) = \log 3x - 2$

$\dfrac{15 - 5x}{10} = 3x - 2$

$15 - 5x = 30x - 20$

$x = 1$

(3 marks)

16. (a) Coordinates of centre (1, -1)

Radius: $r^2 = 1^2 + 3^3 = 10 \Rightarrow r = \sqrt{10}$

(b) Equation

$(x-1)^2 + (y+1)^2 = 10$

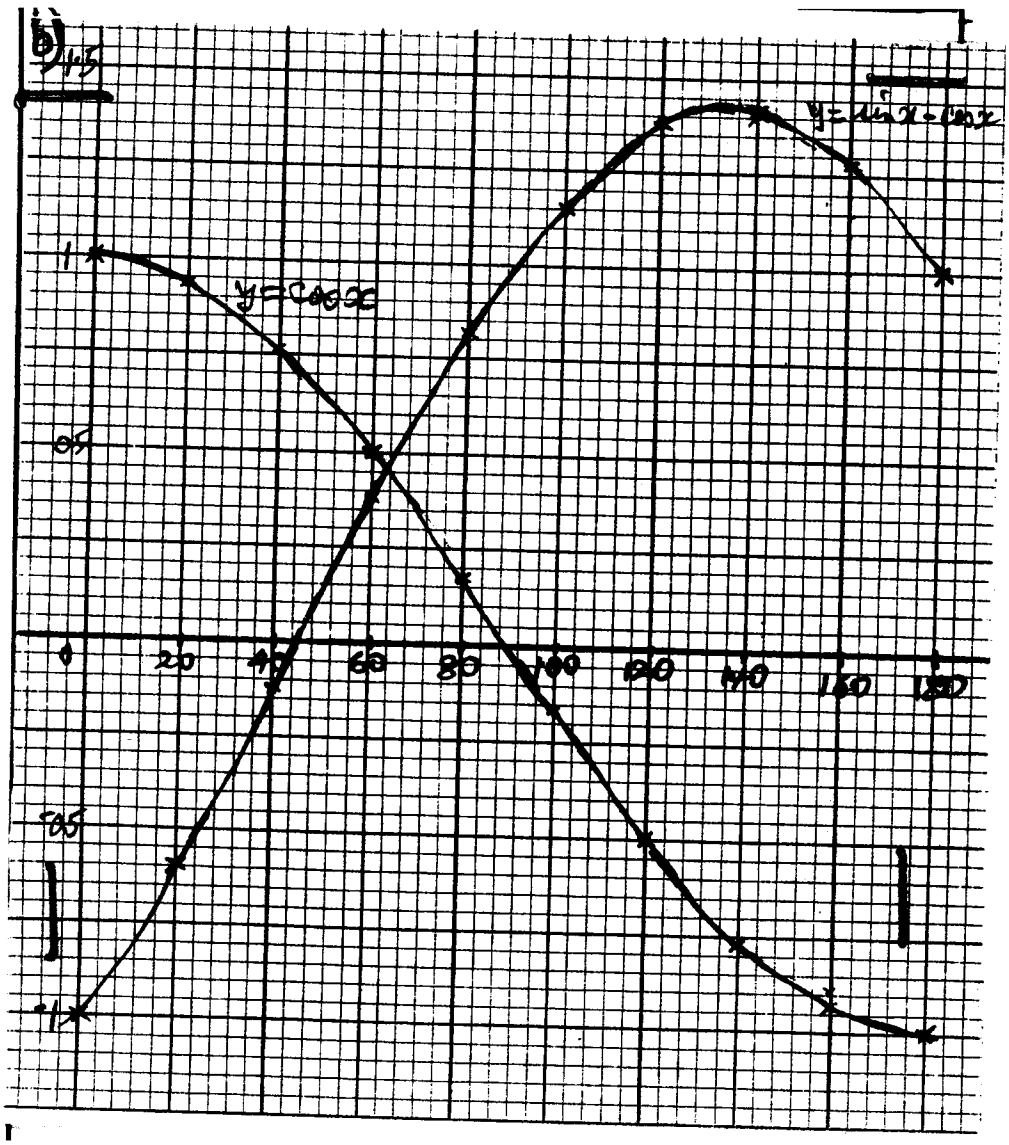
$x^2 - 2x + 1 + y^2 2y + 1 = 10$

$x \ + y^2 - 2x + 2y = 8$

(4 marks)

17.

x^0	0^0	20^0	40^0	60^0	80^0	100^0	120^0	140^0	160^0	180^0
$Cos\, x^0$					0.17		-0.5		-0.94	
$Sin\, x^0 - Cos\, x^0$			-0.13			1.15		1.41		



(c) (i) $\sin x^0 - \cos x^0 = 1.2$

$x^0 = 104,166$

(ii) $\cos x^0 = \frac{1}{2}\sin x^0$

$\Rightarrow \cos x^0 = \sin x^0 - Cos\, x^0 = 63^0$

(iii) $\cos 63^0 = 0.45$

(10 marks)

18. (a) $\boldsymbol{OB} = 3\boldsymbol{p} + 3\boldsymbol{r}$
$\boldsymbol{AJ} = 2\boldsymbol{p} + 2\boldsymbol{r}$

(b) $\boldsymbol{OX} = m(\boldsymbol{OB}) = m(3\boldsymbol{p} + 3\boldsymbol{r})$
$\boldsymbol{OX} = 2\boldsymbol{r} + \boldsymbol{p} + n(2\boldsymbol{p} - 2\boldsymbol{r})$

(iii) $m(3\boldsymbol{p}+3\boldsymbol{r}) = 2\boldsymbol{r}-2n\boldsymbol{r}+\boldsymbol{p}+2n\boldsymbol{p}$
$3m\boldsymbol{p}+3m\boldsymbol{r} = \boldsymbol{r}(2-2n)+\boldsymbol{p}(1+2n)$
$3m\boldsymbol{p} = (1+2n)\boldsymbol{p}$
$3m = 1+2n$ ..... (i)
$3m\boldsymbol{r} = \boldsymbol{r}(2-2n)$
$3m = 2-2n$ ..... (ii)

$1-2n = 2-2n$

$4n = 1 \Rightarrow n = \frac{1}{4}$

Subst. for $n = \frac{1}{4}$ in (i)

$3m = 1+2\times \frac{1}{4}$

$3m = 1\frac{1}{4} \Rightarrow m = \frac{3}{2\times 3} = \frac{1}{2}$

The ratio in which x divides $\boldsymbol{AJ}$

$\boldsymbol{AX} = n\boldsymbol{AJ} = \frac{1}{4}\boldsymbol{AJ}$
Ratio 1 : 3

(10 marks)

19. (a) (i) Angle subtended (longitude)
$16 + 24 = 40^0$
Arc AB $= 60 \text{ x } 40 \text{ x } \cos 34^0$
$= 1989.69 \approx 1990\ nm$

(ii) Arc AC : latitude difference
$= 26 + 24 = 60$
$\therefore$ Arc AC $= 60 \text{ x } 60\ nm = 3600$

(b) (i) local time at B

$1330 + \frac{40}{15}h$

$1330 + 2h40\min$

$1610h$

(ii) time taken to travel from A to B

$= \frac{1990}{40} = 49h45\min.$

Time of arrival:
Wednesday at 1610 + 1h 45 min
= Wednesday 1755h

(10 marks)

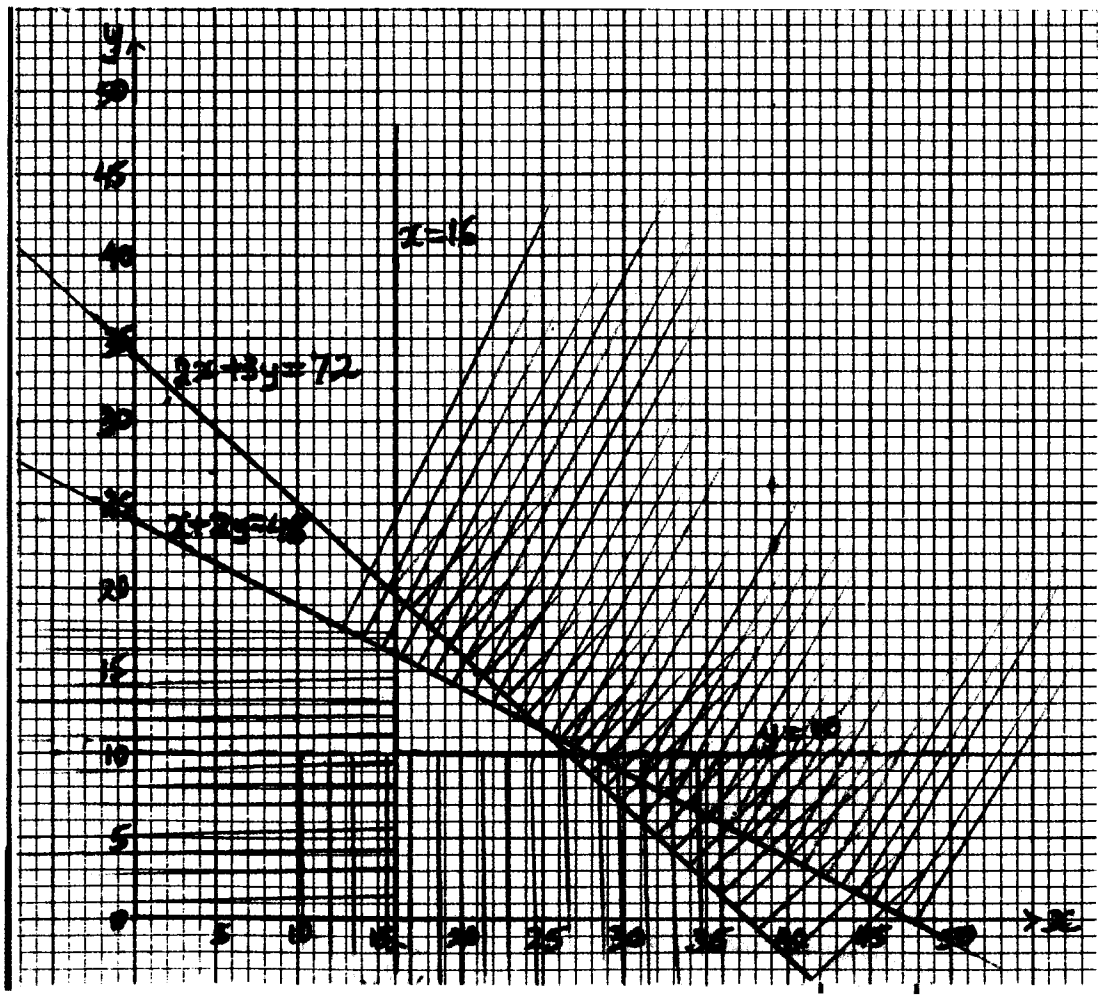
20. (a) $4x+6y \geq 144$

$100x+200y \leq 4800$

$x \geq 16$

$y > 10$

(b)



$2x+3y \geq 72$ drawn and shaded

$x+2y \leq 48$ drawn and shaded

$x \geq 15$

$y > 10$

(c) At least 2 points on vertical axis inspected
Substituting in equation

$$p = 40x100y = 40 \times 16 + 100 \times 16$$
$$= 640 + 1600 = 2240$$

(10 marks)

21. (a) Let number of rows be ***r*** and number of persons per row be ***p***

$$pr = 600 \Rightarrow p = \frac{600}{r}$$
$$(r+5)(p-6) = 600$$
$$(r+5)\left(\frac{600}{r} - 6\right) = 600$$
$$(r+5)(600 = 6r) = 600$$
$$600r - 6r^2 + 3000 - 30r = 600r$$
$$r^2 + 5r - 500 = 0$$
$$(r25)(r-20) = 0$$
$$r = 20$$

(b) No. of rows in new arrangement
20 + 25 = 25

No. of empty spaces per row with 450 people seated

$$\frac{600-450}{45} = 6$$

(10 marks)

22. (a)

$$T_6 = p + 5c$$
$$T_5 = p + 4d$$
$$p + 4d = p + 5c$$
$$4d = 5c$$
$$d = \frac{5}{4}c$$

(b)

$$p + 3d - (p + 3c) = 1\frac{1}{2}$$
$$3d - 3c = 1\frac{1}{2}$$
$$\frac{15}{4}c - 3c = 1\frac{1}{2}$$
$$\frac{3}{4}c = \frac{3}{2} \Rightarrow c = 2$$
$$d = 2\frac{1}{2}$$

(c)

$$S_1 = \frac{1}{2}n(a+\ell) = \frac{1}{2}n(2p+10)$$
$$= 3(2p+10) = 6p+30$$

$$S_2 = \frac{1}{2}n(2p+10) = 2.5(2p+10) = 5p+25$$
$$(6p+30)-(5p+25) = 10$$
$$p+5 = 10$$
$$p = 5$$

(10 marks)

23. (a)

$$5 = k_1 t + k_2 t^2$$
$$80 = 2k_1 + 4k_2 \text{ .....}(i)$$
$$135 = 3k_1 + 9k_2 \text{ .....}(ii)$$

$$(ii)\times 2 \Rightarrow 270 = 6k_1 + 18k_2$$
$$(i)\times 3 \Rightarrow \frac{\pm 240 = \pm 6k_1 \pm 12k_2}{30 = 6k_2 \Rightarrow k_2 = 5}$$

Substitute for k_2 in (i)

$$80 = 2k_1 + 4\times 5$$
$$60 = 2k_1 \Rightarrow k_1 = 30$$

Expression: $S = 30t + 5t^2$

(b) (i) distance when $t = 5$ seconds
$S = 30\times 5 + 5\times 25 = 275$

(ii)

$$560 = 30t5t^2$$
$$5t^2 + 30t - 560 = 0$$
$$t + 6 - 112 = 0$$
$$(t+14)(t-8) = 0$$

Time taken, $t = 8$ seconds

(10 marks)

24. (a) (i)

$$\angle OSR = 90 - 50 = 40$$
$$\therefore ORS = 40$$

(ii)

$$\angle RTS = 30^0 \ and \ \angle RPS = 50^0$$
$$\therefore \angle USP = 30^0 + 50^0 = 80^0$$

(iii) $\angle PQR = 180^0 - 50^0 = 130^0$

(b) (i)

$$PT \times TR = TS^2$$
$$(7 + x)(7) = 9^2$$
$$7x = 81 - 49 = 32$$
$$x = \frac{32}{7} = 4.57$$

(ii)

$$\angle ORP = 40^0$$
$$\cos 40^0 = \frac{\frac{1}{2} \times 4.57}{r}$$
$$r = \frac{\frac{1}{2} \times 4.57}{Cos\,40} = 2.98$$

(10 marks)

30.3.3 Mathematics Alt. B Paper 1 (122/1)

1. $270 \div (90 \times 2) + 7 \times 4 - 40 \div 5$
$= 270 \div 180 + 28 - 8$
$= 21\frac{1}{2}$ 2 marks

2. $7056 = 2^4 \times 3^2 \times 7^2$
$\sqrt{7056} = 2^2 \times 3 \times 7$
$= 84$ 2 marks

3. $\frac{2(^-2) + 3(3+5)}{4 \times 3 \times 5}$
$= \frac{^-4 + 24}{60}$ 2 marks
$= \frac{1}{3}$

4. Width of floor $= \sqrt{37.7^2 - 35.2^2}$

$\therefore$ area of floor $= \sqrt{37.7^2 - 35.2} \times 35.2$

$= 475.2 \text{ m}^2$ 3 marks

5.

NO.	LOG
43.2	1.6355
0.015	+
	$\bar{2}.1861$
	$\bar{1}.8116$
	-
$\sqrt[3]{0.00679}$	$\bar{3}.8319 \div 3$ $\quad \bar{1}.2773$
3.422	0.5343

6. $\angle CBG = 180^0 - 120^0 = 60^0$

$\angle ECB = 90^0$

$\angle BGC = 30^0$ 3 marks

7. $$\frac{3\frac{1}{3} + \frac{6}{7} \times \frac{49}{9}}{\frac{44-35}{10}}$$

$$= \frac{\frac{8}{9}}{\frac{10}{10}}$$

$$= \frac{8 \times 10}{9} = 8\frac{8}{9}$$ 3 marks

8. Volume of water in m^3

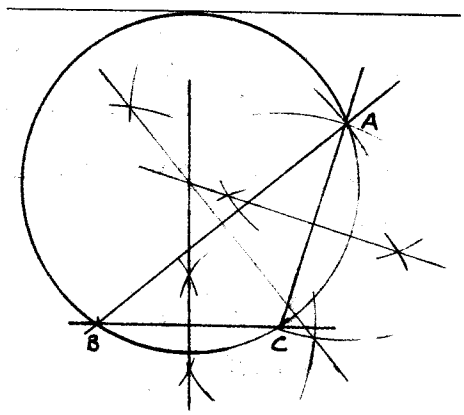
$$= \frac{21000}{100} = 21 \text{ m}^3$$

Height of water

$$= \frac{21}{4 \times 3.5} = 1.5 \text{ m}$$

3 marks

9.



Construction of ΔABC
Construction of $\perp$ as bisectors
Construction of circle

3 marks

10. $3x - 2 < 10 + x \leq 2 + 5x$
$3x - 2 < 10 + x$
$2x < 12$
$x < 6$

$10 + x \leq 2 + 5x$
$-4x < -8$
$-x < -2$
$x \geq 2$

$\therefore\ 2 \leq x < 6$

3 marks

11. Length of $\perp\ a$, $h = 12\ sin\ 36^0$
$= 7.05$

$\therefore$ area of trapezium

$$= \frac{20+8}{2} \times 7.05$$

$$= 98.75\ cm^3$$

4 marks

12. Ratio of increase: 1200:800
= 3:2

Original price for a pair of trousers

$$\frac{t}{2700} = \frac{2}{3}$$

$$t = \frac{2}{3} \times 2700 = 1800$$

3 marks

13. Shaded area

$$= \frac{150}{360} \times \pi \times 10.5^2 - \frac{1}{2} \times 10.5^2 \sin 150^0$$

$$= 144.3169125 - 27.5625$$

$$= 116.7544125 \approx 116.8 cm^2$$

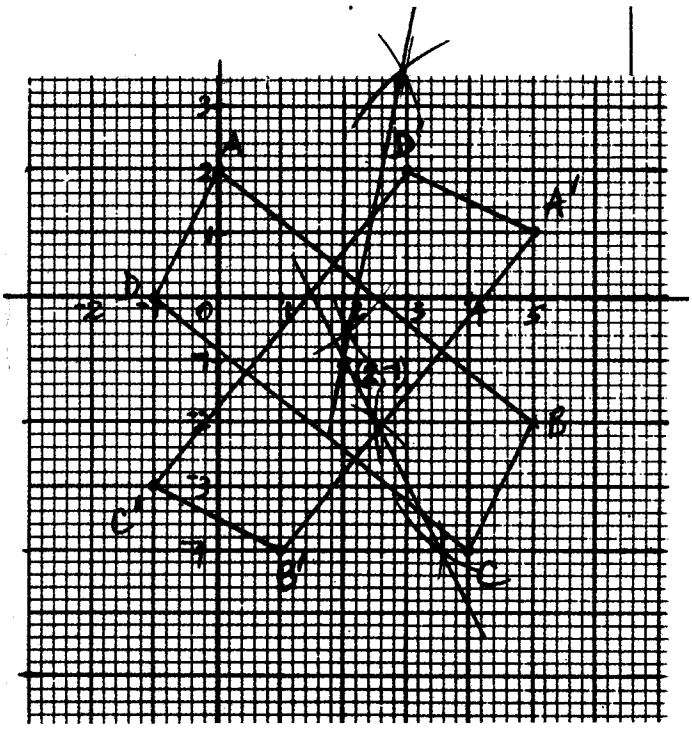
4 marks

14. $25 = 5^2$; $30 = 2 \times 3 \times 5$; $35 = 5 \times 7$

LCM = $2 \times 3 \times 5^2 \times 7$

Time = $\frac{1050}{60} = 17.5h$ 4 marks

15.



a) Construction of at least 2 mediators
Centre of rotation (2,-1)

b) Angle of rotation -90^0 3 marks

16. Commission earned

$$\frac{2}{100} \times 30000 + \frac{3.5}{100} \times (84000 - 30000)$$

$$= 600 + 1890 = 2490$$

Total earnings

12000 + 2490 = 14490 4 marks

17. a) 2400 x 120

= 288000

b) Amount left

288000 – 13500

In Tsh. = 153000 x 16.5

= 2524500

Amount in Tsh spent

$$\frac{40}{100} \times 2524500 = 1009800$$

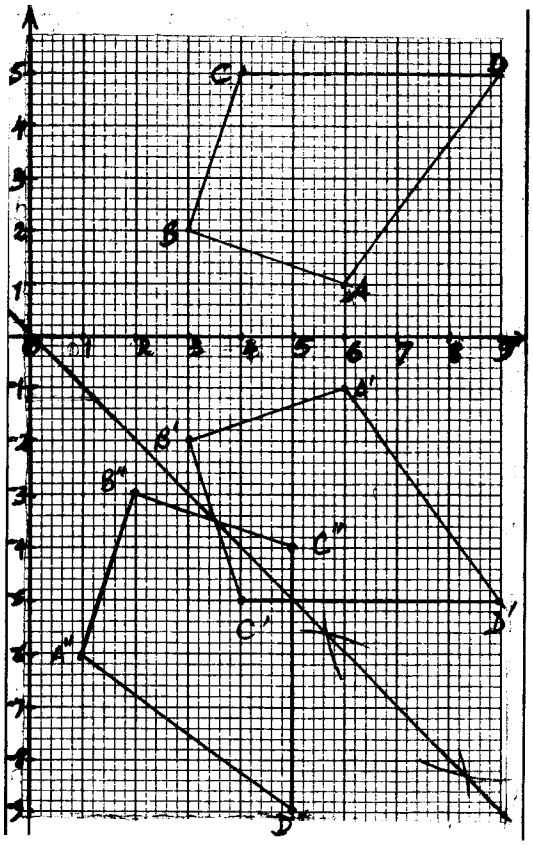
c) Remaining amount in £

$$= \frac{60}{100} \times \frac{153000 \times 16.5}{1980}$$

= £ 765

10 marks

18.



a) Drawing image A'B'C'D'

b) (i) image A"B"C"D"

(ii) mediator(s)

c) (i) equation of line

Gradient $\frac{^-5 - {}^-3.5}{5 - 3.5} = {}^-1$

$\therefore$ equation $y = {}^-x$

(ii) I(1,0) → I'(0,⁻1); J(0,1) → J'(⁻1,0

∴ matrix of reflection in

$y = -x$ is $\begin{pmatrix} 0 & ^-1 \\ ^-1 & 0 \end{pmatrix}$

10 marks

19. a)

$(7x+5)(x+10)$

$= 7x^2+70x+5x+50$

$= 7x^2+75x+50$

b)

$7x^2+75x+50=600$

$7x^2-35x+110x-550=0$

$(7x+110)(x-5=0)$

$x=5$

$\therefore$ *perimeter*

$=2(7\times5+5)+2(5+10)$

$=80+30=110m$

c) $\frac{110}{5} = 22$

10 marks

20. a) Cross sectional area

$=\pi\times(0.3^2-0.26^2)$

$= 0.070371675 \approx 0.07$

b) (i) External surface area

$\pi\times2\times0.3\times6.5+2\times0.07$

$= 12.25221135+0.14$

$= 12.39$

(ii) Internal surface area

$= \pi\times2\times0.26\times6.5$

$= 10.61858317 \approx 10.62$

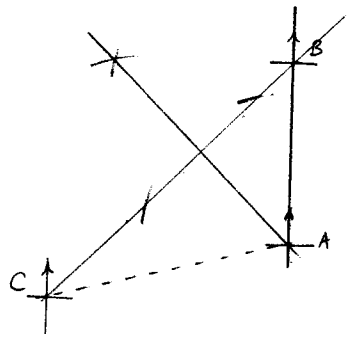
(iii) Total surface area

$12.39+10.62$

$= 23.01m^2$

10 marks

21.



a) Location of B
Location of C

b) Distance of A from C
5.5
5.5 x 100 = 550 km

Bearing of A from C = 255^0

c) Shortest distance of A from BC
Drawing ⊥ ar
Measuring 2.8 cm
Actual distance = 2.8 x 100 = **280 km**

10 marks

22. a) 64 m^3 = 64 x 1000000
= 64000000 cm^3

b) v.s.f. $= \frac{64000000}{512} = 125000$

d.s.f. $\sqrt[3]{12500} = 50$

A.s.f. = $50^2 = 2500$

c) Amount of paint required
= 2500 x 0.004 = 10

Cost = 10 x 120 = 1200

10 marks

23. a) distance travelled:

$$\frac{1}{2} \times 10 \times 20 = 100\,m$$

b) average velocity:

distance: 10 x 25 + ½ x 25 x 20
= 250 + 250 = 500

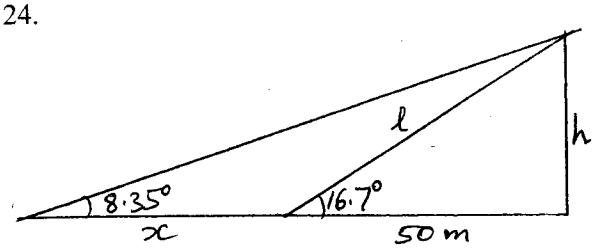
$\therefore$ velocity $\dfrac{500}{45-20} = 20$ m/s

c) acceleration: $\dfrac{0-30}{60-45}$ 4

4 4 4 4 $= \dfrac{-30}{15} = {}^{-}2m/s^2$

10 marks

24.



a) (i) $\dfrac{h}{50} = \tan 16.7^0$

$h = 50\tan 16.7^0 = 15.00071889$

$= 15.00m$

(ii) $\dfrac{50}{l} = \cos 16.7$

$l = \dfrac{5}{\cos 16.7} = 52.20173912$

$= 52.20\,m$

b) $\dfrac{15}{50+x} = \tan 8.35$

$50 + x = \dfrac{15}{\tan 8.35}$

50 + x = 102.1968412

x = 102.1968412 – 50

= 52.20 m

10 marks