(b) (i) Using the valuesin the completed table, draw the graph of $y=2$ sin $3 x$ for $0^{\circ} \leq x \leq 120^{\circ} \theta^{\circ}$ the grid provided
(ii) Hence satve the equation $2 \sin 3 x=-1.5$
24. A manufacture of jam has 720 kg of strawberry syrup and 800 kg of mango syrup fơr making two types of jam, grade A and B. Each types is made by mixing strawberry and mango syrups as follows:

Grade A: 60\% strawberry and 40\% mango
Grade B: $30 \%$ strawberry and $70 \%$ mango
The jam is sold in 400 gram jars. The selling prices are as follows:
Grade A: Kshs. 48 per jar
Grade B: Kshs 30 per jar.
(a) Form inequalities to represent the given information (3 marks)
(b) (i) On the grid provided draw the inequalities (3 marks)
(ii) From your, graph, determine the number of jars of each grade the manufacturer should produce to maximize his profit mark)
(iii) Calculate the total amount of money realized if all the jars are sold
( 1 mark)

1. Use logarithms to evaluate
( 3 marks)
$\sqrt{3 \frac{36.15 s^{s} \times 0.02573}{s^{3}} 1,938}$
2. Factorize completely $3 x^{2}-2 x y-y^{2}$
( 2 marks)
3. The $e^{x}$ cost of 5 skirts and 3 blouses is Kshs 1750. Mueni bought three of the skirts and one of the blouses for Kshs 850.
Find the cost of each item
A man walks directly from point A towards the foot of a tall building 240 m away. After covering 180 m , he observes that the angle of the top of the building is 45 . Determine the angle of elevation of the top of the building from A. ( 3 marks)
4. In the figure below, ABCD is a cyclic quadrilateral and BD is a diagonal. EADF is a straight line. $\angle \mathrm{CDF}=68^{\circ},<\mathrm{CDDC}=45^{\circ}$ and $\angle \mathrm{BAE}=98^{\circ}$.

Calculate the size of
(a) $<\mathrm{ABD}$
(b) $<\mathrm{CBD}$
( 2 marks)
( 2 marks)
6. An employee started on a salary of $£ 6,000$ per annum and received a constant annual increment. If he earned a total of $£ 32,400$ by the end of five years, calculate his annual increment.
( 3 marks)
7. Mr. Ngeny borrowed Kshs. 560,000 from a bank to buy a piece of land. He was required to repay the loan with simple interest for a period of 48 months. The repayment amounted to Kshs 21000 per month.

Calculate
(a) The interest paid to the bank
( 2 marks)
(b) The rate per annume of the simple interest
( 4 marks)
8. A rectangular tank liters of water initially. Water flows into the tank at the rate of 0.5 litres per second Calculate the time in hours and minutes, required to fill the tank ( 4 marks)
9. A car đealer charges $5 \%$ commission for selling a car. He received a confimission of Kshs 17,500 for selling a car. How much money did the owner ceceive from the sale of his car? marks)

Five pupils A, B, C, D and E obtained the marks 53, 41, 60, 80 and 56 respectively. The table below shows part of the work to find the standard deviation.

| Pupil | Mark <br> x | $\mathrm{x}-\mathrm{x}$ | $(\mathrm{x}-\mathrm{x})^{2}$ |
| :--- | :--- | :--- | :--- |
| A | 53 | -5 |  |
| B | 41 | -17 |  |
| C | 60 | 2 |  |
| D | 80 | 22 |  |
| E | 56 | -2 |  |

(a) Complete the table
( 1 mark)
(b) Find the standard deviation
( 3 marks)
11. $A$ and $B$ are two matrices. If $\left.\begin{array}{l}A=1 \\ 4\end{array}\right]_{3} 2$ find $B$ given that $A^{2}=A+B$ ( 4 marks)
12. Solve the equation

$$
\begin{equation*}
\operatorname{Sin} \frac{5}{2} \theta=\frac{-1}{2} \text { for } 0^{0} \leq 0 \leq 180^{\circ} \tag{2marks}
\end{equation*}
$$

13. A fruiterer bought 144 pineapples at Kshs 100 for every six pineapples. She sold some of them at Kshs. 72 for every three and the rest at Kshs 60 for every two.
If she made a $65 \%$ profit, calculate the number of pineapples sold at Kshs 72 for every three
( 3 marks)
14. Make V the subject of the formula

$$
\mathrm{T}=\frac{1}{2} \mathrm{~m}\left(\mathrm{u} 2-\mathrm{v}^{2}\right)
$$

15. The figure below represents a hollow cylinder. The internal and external radii are estimated to be 6 cm and 8 cm respectively, to the nearest whole number. The height of the cylinder is exactly 14 cm .

(a) Determine the exact values for internal and external radii which will give maximum volume of the material used.
(b) Calculate the maximum possible volume of the material used Take the value of to be $22 / 7$
16. Two lorries A and B ferry goods between tow towns which are 3120 km apart. Lorry A traveled at km/h faster than lorry B and B takes 4 hours more than lorry A to cover the distance.

Calculate the speed of lorry B (5 marks)

## SECTION II (48 MARKS)

Answer any six questions from this section
17. The data given below represents the average monthly expenditure, E in $\mathrm{K} £$, on food in a certain village. The expenditure varies with number of dependants, D in the family.

| Dependants | 3 | 7 | 12 | 25 | 32 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Expenditure E ( <br> K£) | -210 | 250 | 305 | 440 | 500 |

(a) Using the grid provided, plot E against D and draw the line of the best fit ( 2 marks)
(b) Find the gradient and the E-intercept of the graph
(c) Write down an equation connecting E and D
(d) Estimate the cost of feeding a family with 9 dependants
18. The table below shows the infome tax rates

| Total income per monet in |  |
| :--- | :--- |
| Kenya | Rate in shillings per <br> pound |
| $1-325$ | 2 |
| $326-650$ | 3 |
| $651-975$ | 4 |
| $976-1300$ | 5 |
| $1301-s^{2} 625$ | 7 |
| Over 625 | 7.50 |

Mr Otiende earned a basic salary of Kshs 13,120 and a house allowance of $\$$ shs 3,000 per month. He claimed a tax relief for a married person of Kshs 455 per month
(a) Calculate
(i) The tax payable without the relief
(ii) The tax paid after the relief
(b) Apart from the income tax, the following monthly deductions are made. A service charge of Kshs 100, a health insurance fund of Kshs 280 and $2 \%$ of his basic salary as widow and children pension scheme.
Calculate
(i) The total monthly deductions made from Mr. Otiende's income
( 2 marks)
(ii) Mr. Otiende's net income from his employment
19. The equation of a curve us $y=3 x^{2}-4 x+1$
(a) Find the gradient function of the curve and its value when $x=2$ ( 2 marks)
(b) Determine
(i) The equation of the tangent to the curve at the point $(2,5)$ ( 2 marks)
(ii) The angle which the tangent to the curves at the point $(2,5)$ makes with the horizontal
(iii) The equation of the line through the point $(2,5)$ which is perpendicular to the tangent in (b) (i)
20. The position of two A and B on the earth's surface are ( $36^{\circ} \mathrm{N}, 49^{\circ} \mathrm{E}$ ) and ( $360^{\circ} \mathrm{N}, 131^{\circ} \mathrm{W}$ ) respectively.
(a) Find the difference in longitude between town A and town B ( 2 marks)
(b) Given that the radius of the earth is 6370, calculate the distance between town A and town B.
(c) Another town, C is 840 east of town B and on the same latitude as towns A and B. Find the longitude of town C.
21. The table below shows some values of the function $y=x^{2}+2 x-3$

a) Complete the table
b) Using the completed table and the mid- ordinate rule with six ordinates, estimate the area of the region bounded by the $y=x^{2}+2 x-3$ and the fine $y=0, x=-6$ and $x=-3$ ( 3 marks)
(i) B ${ }^{x}$ y integration find the actual area of the region in (b) above 2 marks) (ii), Calculate the percentage error arising from the estimate in (b) (2 marks)

In the diagram below OABC is a parallelogram, $\mathrm{OA}=\mathrm{a}$ and $\mathrm{AB}=\mathrm{b} . \mathrm{N}$ is a point on OA such that ON: NA = 1:2

(i) AC in terms of a and b
(ii) BN in terms of a and b
(b) The lines $A C$ and $B N$ intersect at $X, A X=h A C$ and $B X=k B N$
(i) By expressing OX in two ways, find the values of h and k
(ii) Express OX in terms of a and b
( 1 mark)
23. Use ruler and compasses only in this question

The diagram below shows three points A, B and D
(a) Construct the angle bisector of acute angle BAD
( 1 mark)
(b) A point P, on the same side of AB and D , moves in such a way that <

APB $=221 / 2^{0}$ construct the locus of P
( 6 marks)
(c) The locus of P meets the angle bisector of $<\mathrm{BAD}$ at C measure $<\mathrm{ABC}$
( 1 mark)

## SECTION II (48 Marks)

## Answer any six questions from this section

17. Two businessmen jointly bought a minibus which could ferry 25 paying passengers whén full. The fare between two towns A and B was Kshs 80 per passengers for one way. The minibus made three round trips between two towns dadify. The cost of fuel was Kshs 1500 per day. The driver and the conduêtôr were paid daily allowances of 200 and Kshs 150 respectively.

A 通 doan payment.
(a) One day, the minibus was full on every trip.
(i) How much money was collected from the passengers that day?
(ii) How much was the net profit?
(b) On another day, the minibus was $80 \%$ full on the average for the three round trips, how much and each businessman get if the day's profit was shared in the ratio of $2: 3$
18. In the figure below AOC is a diameter of the circle centre $\mathrm{O} ; \mathrm{AB}=\mathrm{BC}$ and $<$ $\mathrm{ACD}=25^{\circ}$, EBF is a tangent to the circle at $\mathrm{B} . \mathrm{G}$ is a point on the minor arc CD.

(i) $<\mathrm{BAD}$
( 3 marks)
(ii) the Obtuse < BOD
( 3 marks)
(iii) < BGD
( 1 mark)
(b) Show the $<\mathrm{ABE}=<\mathrm{CBF}$. Give reasons
( 2 marks)
19. In an agricultural reseaneh centre, the length of a sample of 50 maize cobs were measured and recorded as shown in the frequency distribution table below.

| Length in cm | Number of cobs |
| :---: | :---: |
|  | 4 |
| $13 \%-13$ | 7 |
| ${ }^{5} 514-16$ | 11 |
| 17-19 | 15 |
| 20-22 | 8 |
| 23-25 | 5 |

## Calculate

(a) The mean
(b) (i) the variance
(ii) The standard deviation
( 8 marks)
20. Four towns R, T, K and G are such that $T$ is 84 km directly to the north $R$, and $K$ is on a bearing of $295^{\circ}$ from $R$ at a distance of $60 \mathrm{~km} . \mathrm{G}$ is on a bearing of $340^{\circ}$ from K and a distance of 30 km . Using a scale of 1 cm to represent 10 km , make an accurate scale drawing to show the relative positions of the town.

Find
(a) The distance and the bearing of T from K
(b) The distance and the bearing G from T
(c) The bearing of R from G
21. Kubai saved Kshs 2,000 during the first year of employment. In each subsequent year, he saved $15 \%$ more than the preceding year until he retired.
(a) How much did he save in the second year?
(b) How much did he save in the third year?
(c) Find the common ratio between the savings in two consecutive years
(d) How many years did he take to save the savings a sum of Kshs 58,000?
(e) How much had he safied after 20 years of service?
22. A school has to take 384 people for a tour. There are two types of buses available, type X and type Y . Type X can carry 64 passengers and type Y can carry 48 passengers. They have to use at least 7 buses.
(a) Form 911 the linear equalities which will represent the above information ( 3 marks)
(b) On the grid provided, draw the inequalities and shade the $e^{2}$
Unwanted region (3 marks)
(c) the charges for hiring the buses are

Type X. Kshs 25000
Type y: Kshs 20000
Use your graph to determine the number of buses of each type that should be hired to minimize the cost.
23. Complete the table given below using the functions.
$Y=-3 \cos 2 x^{0}$ and $y=2 \sin \left(3 / 2 x^{0}+30^{\circ}\right)$ for $0<x<180^{\circ}$

| $\mathrm{X}^{0}$ | $0^{0}$ | $20^{0}$ | $40^{0}$ | $60^{0}$ | $80^{0}$ | $100^{0}$ | $120^{0}$ | $140^{0}$ | $160^{0}$ | $180^{0}$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $-3 \cos 2 \mathrm{x}^{0}$ | - |  |  | 1.50 | 2.82 | 2.82 |  | 0.52 | - |  |
| 3.00 |  |  |  |  |  |  |  | 2.30 |  |  |
| $2 \sin \left(3 / 2 \mathrm{x}^{0}+\right.$ <br> $\left.30^{\circ}\right)$ | 1.00 |  | 2.00 | 1.73 |  | 0.00 | - |  |  | - |

(a) Using the grid provided, draw the graphs $y=-3 \cos 2 x o$ and $y=2 \sin$ $\left(3 / 2 x^{0}+30^{\circ}\right)$ on the same axes.
Take 1 cm to represent $20^{\circ}$ on the x - axis and 2 cm to represent one unit on the y - axis.
( 4 marks)
(b) From your graphs, find the roots of $3 \cos 2 x+\sin \left(3 / 2 x^{0}+30^{\circ}\right)=$ 0
24. Data collected form an experiment involving two variables X and Y was recorded as shown in the table below

| x | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| y | -0.3 | 0.5 | 1.4 | 2.5 | 3.8 | 5.2 |

The variables are known to satisfy a relation of the form $y=a x^{3}+b$ where $a$ and $b$ are constants
(a) For each value of $x$ in the table above, write down the value of $x^{3}(2$ marks)
(b) (i) By drawing a suitable straight line graph, estimate the values of a and b

( 2 marks)
(ii) Write down the relationship connecting $y$ and $x$


